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Effects of representational systems on text processing by first and second language readers of Chinese : an exploratory study of pinyin, zhuyin, and characters.

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EFFECTS OF REPRESENTATIONAL SYSTEMS ON TEXT PROCESSING BY FIRST AND SECOND LANGUAGE READERS OF CHINESE: AN EXPLORATORY STUDY OF PINYIN, ZHUYIN, AND CHARACTERS

A Dissertation Presented

by

SHOU-HUA LIN

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ABSTRACT

EFFECTS OF REPRESENTATIONAL SYSTEMS ON TEXT PROCESSING BY FIRST AND SECOND LANGUAGE READERS OF CHINESE: AN EXPLORATORY STUDY OF PINYIN, ZHUYIN, AND CHARACTERS

FEBRUARY 1993

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Researchers have discovered that native speakers (NSs) and non-native speakers (NNSs) of Mandarin Chinese use different strategies in recalling visual-based texts. Since written Chinese can be represented in logograph, syllabary, and alphabet, it is important to know how and to what extent a representational system (RS) will affect the processing of Chinese texts by both NSs and NNSs.

The two surveys in this study explored the effects of RSs on text processing by NSs and NNSs of Chinese. Native groups consisted of subjects from Taiwan and China and were asked in the first survey to match Chinese vocabulary items in pinyin and in characters to their closest English equivalents in meaning. Subjects in the second survey, which included two native and one non-native groups, identified Chinese syllables in either pinyin or zhuyin version, discriminated the differences of sounds of identical characters, and chose the right words to fit in the phrase-level contexts. Two conceptual hypotheses were proposed and tested: (1) NSs of Chinese will demonstrate better performance than NNSs in reading texts represented in Chinese characters, and

characters, and (2) NNSs of Chinese will demonstrate better performances than NSs in comprehending texts represented in pinyin in terms of accuracy and speed.

The findings show that (1) Beginning and intermediate non-native learners of Mandarin Chinese benefited from alphabetic representation of the Chinese language in terms of processing speed and accuracy rate—requiring less time and achieving higher performances; and (2) Native Chinese who learned either zhuyin or pinyin as a primer demonstrated lower performances in processing texts represented in either zhuyin or pinyin in terms of speed and accuracy.

The findings suggest that logographic representation might provide more rapid and precise access than syllabic and alphabetical representations for text processing at the advanced level. One particular pattern is apparent: An RS which is more efficient at the beginning level will become less efficient at the advanced level and *vice versa*. This implies that instructors should teach both RSs, logographic plus syllabic or alphabetic systems, to beginning readers, and switch to logographic representation once the learning of the two systems become balanced.

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LIST OF ABBREVIATIONS

The following abbreviations and acronyms are commonly used in the academia or referred elsewhere in the text of this document:

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
BK	background knowledge
CFL	Chinese as a foreign language
CSL	Chinese as a second language
CT	complex (complicated) text (or *fantizi*)
ESL	English as a second language
IPA	international phonetic alphabet
KR	Kwoyeu Romatyzh
L1	first language
L2	second language
MPS	Mandarin phonetic symbols (or *zhuyin*)
NNS	non-native speaker
NS	native speaker
PRC	People's Republic of China
PTS	phonetic transcription system
ROC	Republic of China on Taiwan
RS	representational system
ST	simplified text (or *jiantizi*)
STM	short-term memory/memorization
UPC	Universal Product Coding

CHAPTER 1
INTRODUCTION

This chapter is divided into nine sections. Section one is a brief introduction to some of the representational systems we use. Section two presents the background of this study by discussing some previous experiments. The problem and purpose of this study are stated in sections three and four. Research questions and limitations of the study are in sections five and six. Section seven outlines the organization of the study. Section eight states the educational significance of this study. Technical terms used in this study and related fields are defined in section nine.

1.1 Representational Systems: An Introduction

In our society, we use numerous systems for representing our ideas and for conveying meanings. These systems include symbols, graphics (icons), numbers, and verbal and printed texts. Meanings are embodied in one or more systems and are represented in various forms, which are commonly known as *codes*, "a set of rules or constraints for transforming one group of signifying units into another" (Jackson, 1991, p. 42). We refer to these systems as *representational systems* (RSs), or *meaning systems*, or *code systems* interchangeably.

To illustrate, numbers one through ten, as in (1.1), can be expressed in several RSs: in Roman numerals (1.2); in English (1.3); and in *Pinyin* (1.4), a phonetic transcription system of Chinese, as shown in Figure 1.1. If the numbers are converted into *bar code* as found on UPC (Universal Product Coding) labels, or computer codes such as the ANSI (American National Standards Institute) code, the ASCII (American Standard Code for Information Interchange) code,

binary or hexadecimal code, they will be beyond the comprehension of most people. In other words, these codes are used as RSs of numbers. If we add the English alphabet (1.5) to corresponding numbers two through nine, as seen on telephones, or use graphic expressions as on game cards or dice, or use aural-based expressions as tapping, or implement musical notes to correspond to numbers one through seven (1.6), the interactions among these RSs become more complicated.

(1.1)	1	2	3	4	5	6	7	8	9	10
(1.2)	I	II	III	IIII (IV)	V	VI	VII	VIII	IX	X
(1.3)	one	two	three	four	five	six	seven	eight	nine	ten
(1.4)	yi	èr	san	sì	wu	lìu	qi	ba	jiu	shí
(1.5)		ABC	DEF	GHI	JKL	MNO	PRS	TUV	WXY	Oper
(1.6)	d o	r e	m i	f a	s o	l a	t i			

Figure 1.1 Numbers in various representational systems

For example, telephone numbers with English texts, such as 1-800-FOR-SALE and 1-900-FOR-HELP, are easier for callers to memorize than their corresponding numbers, 1-800-367-7253 and 1-900-367-4357. But making phone calls like these two would definitely be slower than dialing the numbers, when callers need to convert the texts into numbers. Meanwhile, each number has its specific "dial tone," or "pulse," therefore telling the numbers by mere listening to the tones is possible but would require special training and practice. These diverse representations convey the same "core concepts" of numbers.

Similarly, the English alphabet can be represented in combinations of dots as in the Braille system, or of dots and lines as in Morse code. Abbreviated texts can also form a specific RS. Commonly seen examples are the RSs of time expressed in condensed texts (such as Sa and Su for Saturday and Sunday) and special symbol sets, predominantly found in bus, train or flight schedules,

schedules of sports events, and stock market reports. Knowledge acquisition about individual RSs becomes a *sine qua non* for one to be functionally literate and decode the meanings of various texts.

1.2 Background

Language learning accounts for two of the three basics (reading, writing, and arithmetic) in schooling. Learning various RSs associated with these basics is essential in literacy acquisition. The purpose of language arts instruction, which has taken up so many years of schooling up to the high school and college levels, is to help learners achieve communicative competence in all language skills and a knowledge of general and specific disciplines. Reading and writing are highly complex communicative skills that require one to make use of one's *knowledge base*, an "assemblage of information about logic, relationships and descriptions of behavior" (Harrar, 1990), and convert it into a verbally comprehensible form. Language learners will learn the associative systems embedded in the language, such as phonetic symbols, syntactic rules, morphological structures, meanings of individual words and so forth. An analysis of reading texts will inevitably involve a discussion of an essential RS embedded within—the graphemic representation.

Reading text, in traditional usage, requires visual, oral, and/or tactile processing. If reading is interpreted in terms of information processing, reader's reading behavior can be categorized, according to the types of sensory processing involved, as: Visual-based (silent reading, *yuedu* or *modu*), oral-based (sound reading, or *rangdu*), and tactile-based (touch reading). Commercially available "talking books" assume an auditory approach to "reading" and the Braille system for the blind a tactile approach. Visual-based

processing can be analyzed from either reader's perspectives or the reading texts. The following paragraphs discusses the RSs of the reading texts of Chinese.

Researchers have classified the RSs of reading texts into three major categories: Logographic, syllabic, and alphabetic characters (Gibson and Levin, 1975; cited in Cheng and Joula, 1982). Logographs represent lexical morphemes, as in Chinese or Japanese Kanji or Korean Hangul; while syllabaries represent syllables, as in Japanese Kana; and alphabets represent phonemes, as in English (Wang, 1981; Cheng and Joula, 1982). Chinese language can be represented in the three RSs: logographic (characters), syllabic (zhuyin), and alphabetic (pinyin) systems.

The RSs of Chinese characters, which are basically of graphemic, ideographic, pictorial or logographic constructions, and the phonetic or phonological system for them are independent of each other, and can be learned individually (Tzeng, Garro, and Hung, 1978; Tzeng and Hung, 1981; Wang, 1981). Therefore, being able to write characters does not necessarily entail being able to pronounce them, and *vice versa*. Learners will have to build up a fixed link between sounds and characters by recognizing individual Chinese ideographs and memorizing their respective sounds by virtue of a mediational system, commonly known as the *phonetic transcription system* (PTS).

PTSs are syllabic or phonetic systems to represent the sounds of written Chinese. Two most commonly used PTSs in learning Chinese as a first language (L1) and as a second language (L2) are: Zhùyin fúhào and pinyin. Zhùyin (or Chuyin) fúhào, also known as "Mandarin phonetic symbols" (MPSs), is a syllabic system that comprises a set of symbols taken from parts of the Chinese script. Pinyin is a *romanization system*, a syllabic system that employs Roman alphabet to represent the sounds of Chinese logographs. Given the account that learning Chinese can involve with learning three RSs, it will be of great significance for

an instructor to know which RS will be optimal to learners of various proficiency levels.

Researchers found that native speakers (NSs) and non-native speakers (NNSs) of Mandarin Chinese used different strategies in recalling visually-based Chinese texts that were visually presented for a short span of time (Chu-Chang and Loritz, 1977; Biederman and Tsao, 1979; Zhang and Simon, 1985; Hayes, 1987a, 1987b, and 1988; Perfetti and Zhang, 1991). In an attempt to unveil the short term memorization (STM) strategies used by bilingual adults, Chu-Chang and Loritz (1977) administered word-recognition tests on Chinese and English to 22 Cantonese-Chinese and 16 English-Spanish bilinguals. Fifteen slides, each with six Chinese characters, and eighteen slides, each with four English words, served as stimulus lists and were presented for subjects to recall. Subjects answered on the response lists, which contained one word more than the stimulus lists. Each slide contained visual, phonological and semantic *distractors*, the characters or words that bear graphemic resemblance or are phonological or semantic equivalents of controlled characters or words. They found that Chinese subjects encoded ideographs phonologically while Chinese and Spanish (ESL) learners encoded English words visually. They remarked, "The first language strategy for learning to read Chinese may rely heavily upon visual shape-meaning association because the shape of Chinese written words has a closer relationship to meaning than does the shape of English or Spanish words" (p. 347). Their study was further extended by Hayes (1987a and 1988).

Hayes undertook two experiments on word recognition strategies used by native speakers (NSs) and non-native speakers (NNSs) of Mandarin Chinese. Two groups of participants in the two experiments included 17 NSs of Mandarin Chinese from Taiwan attending various disciplines at Ohio State University and 17 NNSs with proficient levels of Mandarin Chinese. Experiment I, a substantial

replication of Chu-Chang and Loritz's experiment, tested word recognition strategies at the word level, and Experiment II at sentence level. In Experiment I, fifteen slides, each containing six Chinese characters in random order, were shown for four seconds, followed by a response period. Slides contained phonological, graphical or semantic distractors. Subjects, using a response booklet, circled the characters they thought they had seen on each slide. In Experiment II, subjects were shown slides containing a complete Chinese sentence and a distractor. They had to determine whether the statement was true or false.

The results demonstrated that (1) NSs made significantly more phonological errors than NNSs did at the word level; and (2) NNSs made significantly more graphic errors than NSs did at the sentence level. He concluded that (1) The NSs, at the sentence level of processing, used a mix of graphic and semantic processing strategies; and (2) NNSs seemed to rely heavily on the graphic processing strategy while reading sentences.

It is important to notice that Chu-Chang and Loritz's phonological distractors were meant for Cantonese speakers, hence, their test items might not necessarily serve as phonological distractors for speakers of Mandarin Chinese (see Figure 1.2), a factor that Hayes seemed to have overlooked. [The situation is the same with Perfetti and Zhang's (1991, see p. 643 for examples) character-identification experiments. If one wants to replicate their experiments, one has to consider the factor that 26 out of the 34 pairs of stimulus-characters serve as graphic distractors only to readers of simplified text (ST) but *not* to readers of complex text (CT).]

Chinese characters		Pronunciation in			
		Cantonese		Mandarin	
狹	洽	hap	hap	xía	qià
道	度	dou	dou	dào	dù
九	狗	gao	gao	jiǔ	gǒu
保	補	bou	bou	bǎo	bǔ

Figure 1.2 Chinese characters used in Chu-Chang & Loritz (1977) and Hayes (1987a)

Since Chinese has three types of representations, we can expect that Chinese is decoded or processed in three ways. Will one of the RSs enjoy any advantage over the others in text processing? Since Chu-Chang and Hayes dealt with either native speakers or non-native advanced learners of Chinese, it is worth exploring in how the RSs of Chinese will affect text processing by native versus non-native readers.

1.3 Statement of Problem

Written Chinese has three types of representation, namely, in logographic, syllabary, and alphabetical, and one type of RS is normally learned earlier than others with the final goal of achieving proficiency in reading logographs. Since Chinese differs from syllabic representations of English and taking into account the studies that showed different encoding strategies between NSs and NNSs, it is worth knowing how and to what a representation system will affect the

processing of Chinese texts by both native and non-native speakers, and whether pinyin system offers NNSs a greater advantage.

1.4 Purpose of The Study

Since the study of the effect of representational systems on language learning appears to be relatively scarce in L2 literature, this research is intended as an exploratory study. This research will extend the studies conducted by Chu-Chang and Loritz (1977) and Hayes (1987a) by exploring the effect of RSs on text processing by native and non-native readers of Mandarin Chinese.

1.5 Research Questions

This study intends to answer the following two questions:

1. Will specific representational systems make any difference to native speakers in comprehending Chinese texts in terms of accuracy and speed? And
2. Will a specific representational system differentially affect native and non-native speakers in comprehending Chinese texts in terms of accuracy and speed?

To answer these questions, native speakers of Chinese from both China and Taiwan and non-native learners in the United Stated of America will be given two tests of Chinese vocabulary, isolated and contextual texts in pinyin and in characters (in complex text version).

1.6 Limitations

Random sampling procedures were not exercised in either the selection of subjects or of test materials due to limited availability of non-native speakers of Chinese and restricted access to the subjects' background knowledge about the

Chinese language. Hence, the results of this exploratory study is not intended to be generalized to all non-native readers of Chinese.

1.7 Organization of The Study

This study consists of five chapters. Chapter One includes an introduction to representational systems, the background and purpose of this study, research questions and limitations, and definitions of terms used in the following chapters.

Chapter Two focuses on a review of the literature in related issues. Chapter Three describes the subjects, research design, and methodology in two experiments. Chapter Four provides analyses of data, errors and findings. Chapter Five summarizes the results of the study, conclusions, and recommendations for further research.

1.8 Educational Significance of The Study

This research will contribute to the area of Teaching Mandarin Chinese as a second/foreign language (CSL/CFL). As an ESL instructor to Chinese students in Taiwan and a CSL (Chinese as Second Language) instructor to America-born Chinese and Americans, I have been concerned with RSs involved with language learning. It will be beneficial for instructors and learners to realize the "optimal" RS in learning Chinese and recognize the role RSs are playing—their applications and limitations.

1.9 Definition of Terms

Certain concepts which are referred to in this paper are defined as follows. Definitions taken or adapted from authoritative sources are cited; others are mine.

association

The linkage between any two words or objects.

channel

The medium or pathway for message transmission, e.g., human sensory organs, telecommunication devices.

character

A graphic symbol for written Chinese.

code

"Any system of signals which can be used to send a message" (Richards, Platt & Weber, 1986, p. 42); or "A set of rules or constraints for transforming one group of signifying units into another." (Jackson, 1991, p. 42)

coding

A process of converting information into the symbols of any communication system.

competence

The development of the ability to acquire and use the knowledge associated with a particular language (linguistic competence) or technology (technological competence) for applicable purposes.

communication

A process that involves two (or more) parties in exchanging (delivering and receiving) information via some channels.

communicative competence

The ability to apply rules of a communication system (such as grammar rules in natural language, or commands and syntactic rules in computer language) and to know to use the system appropriately. (Rf. Richards, Platt & Weber, 1986, p. 49)

context

An environment where a particular meaning is assigned to or associated with.

data base (or **database**)

An assemblage of facts or information in a memory system.

decoding

The process of interpreting information in memory storage in a meaningful way.

distractor

A word or a character that bears resemblance in either shape, pronunciation or meaning with a stimulus word in a word recognition or recall experiment. (Chu-Chang and Loritz, 1977; Hayes, 1987a, 1988)

encoding

The process of transforming incoming stimuli into memory traces. (Le Voi, 1986, p. 107)

frame

A schema that consists of general knowledge about the properties of particular objects and locations. (Cohen, 1986, p. 28)

grapheme

A pictorial symbol to signify a message.

ideogram, or **ideograph**

A written form of Chinese characters, evolved normally from pictures or symbols, to suggest meaning or represent an idea or an object.

information

Knowledge obtained from external sources such as perception and investigation.

information processing

A process in which assorted meanings of an incoming stimulus are acquired, analyzed, organized and assigned to storage for recall or retrieval.

infralogical structures

"Substance of experience" that "represent actual objects or things in the environment." They are considered as one of the three "knowledge layers or levels of representation." The other two layers are *logological* and *linguistic* (Johnson, 1991, p. 193). *Prototypes, schemata*, and *scripts* all belong to *infralogical structures*.

input

Information that is fed or read into a memory device for further processing; the act of feeding data (e.g., by keying-in, scanning) into a processor.

internal lexicon

"The representation of words in permanent memory." (Carroll, 1986, p. 146)

kana

A system of written Japanese, composed of parts of "script-typed" Chinese characters, to represent the sounds or syllabic structures of spoken Japanese.

kanji

A form of written Japanese consisting of Chinese characters. Literally, *hanzi*, "Chinese characters."

knowledge base

An "assemblage of information about logic, relationships and descriptions of behavior." (Harrar, 1990)

lateralization (localization)

The specification or localization of the left or right hemisphere of the brain for various functions or activities. Left hemisphere shows preference in processing speech, whereas right in performing visual and spatial tasks. Common terms are: Visual lateralization, cerebral lateralization, and cerebral location.

lexical schema

The contextual structure of a lexical item in its comprehension.

lexicon

In broad sense, a complete list of words in a language. In generative-transformational grammar, the words or phrases in a base component, i.e., lexical component.

linguistic structures

The highest of the three "knowledge layers or levels of representation," which "mediate the function of communication among humans" and "encode invariances in the linguistic environment (e.g., lexical terms, grammatical relations)." Linguistic structures take their meaning from other structures (either infralogical or logological) for which they stand. (Johnson, 1991, p. 194)

literacy

"The ability to read and write in a language" (Richards, Platt & Weber, 1986, p. 168). Broadly (as used here), the ability to comprehend the meaning conveyed in any media or contexts, e.g., visual literacy, audio literacy, computer literacy, cultural literacy, etc..

logograph

(See **ideogram**.)

logological structures

Second of the three "knowledge layers or levels of representation," which "embody invariances across types of objects or situations" and "encode into kinds (classes, relations, propositions) the diversity of infralogical (i.e., particular-experiential) structures." They represent "common characteristics of the infralogical token structures from which they are constructively abstracted" and are equivalent to Piaget's *logical structures.* (Johnson, 1991, pp. 193-194)

mental lexicon

(See **internal lexicon**)

mental representation

The memory in our mind.

message

A segment of knowledge conveyed or to be conveyed from a sender to a receiver. "A pattern of information that remains constant across a transformation from one group of signifying units into another." (Jackson, 1991, p. 42)

network (or **net**)

A web-like system that connects or links with various units of systems or data bases, such as lexical network, semantic network. In our brain, for example, numerous nerve cells, or neurons, interconnect (synapse) to form a neural net.

orthography

The system of representing sounds of a language using written or printed symbols, such as alphabet.

phonetic transcription

The use of a specific set of symbols to represent sounds of a language. *Pinyin* and *zhuyin fuhao* are examples of phonetic transcription systems commonly used to learn Mandarin Chinese.

phonological encoding

"The identification of visual verbal material on the basis of its phonological rather than its visual features." (Muchisky, 1983, p. 77)

pictogram, or **pictograph**

(See **ideogram**.)

recoding

The process of converting information from one communication system into symbols to be used in another system, or "mental transformation in symbol system." (Salomon, 1979, p. 216)

representation

Symbolic expression or memory of an idea.

representational system

A set of specific symbols or signs with rules to convey meanings or specify functions, such as mathematics symbols, astrological signs, bar code, and many others.

response

A reaction that is provoked or triggered by a stimulus.

romanization

A process of using the Roman alphabet to transcribe or represent the pronunciation of Chinese characters.

schema (Plural: **schemas** or **schemata**)

1. A mental representation which incorporates all knowledge of a specific event or object from past experience (Cohen, 1986, p. 26). **2.** Representation of linguistic units in a non-syllabic language, such as Chinese characters, or *Kanji* in Japanese.

script

1. A schema that consists of general knowledge about particular kinds of events (Cohen, 1986, p. 28). **2.** The written text of a non-syllabic language, such as Chinese, Japanese kanji, Sanskrit, etc.

stimulus

A source code that is used to initiate a response or reaction.

strategy

Procedures or steps taken to accomplish a goal.

syllabary

A set of written symbols to represent the syllables of a language, such as kana for Japanese.

CHAPTER 2
REVIEW OF THE LITERATURE

This chapter consists of four sections. The first section introduces some insights about the Chinese language: distinctive features of Chinese, and gaps and interactions between Chinese script and speech. Section two discusses and comments on issues in learning and teaching Chinese in terms of text processing. These issues include background knowledge, lateralization, and representational systems. Section three comments on a few text-processing experiments and argues that the factor of representational systems embedded in the texts of these experiments has been overlooked and which I assume can affect even native speakers' comprehension of texts. The last section is a brief summary of this review.

2.1 The Chinese Language: Some Preliminaries

Chinese differs distinctly from a Western language such as English or French in that words are constructed not only by means of vowel and consonant combinations, but also based on the distinctive tone of each syllable that is associated with a particular word (Restak, 1988, p. 220). Distinctive features include: (1) Four (or five) tone values for each syllable (see Appendix A); (2) monosyllabic morphophonemic structure for each character; (3) non-inflectional morphological structure; and (4) independent writing and reading systems (Wang, 1981, p. 229).

Chinese logographs were traditionally divided into six categories when Xu Shen first compiled in 121 A. D. the dictionary *Shuowen Jiezi*, which included 9,353 logographs and of which 82 percent in phonograms: (1) *xiangxing*

(pictograms); (2) *zhishi* (simple ideograms); (3) *huiyi* (complex ideograms); (4) *jiajie* (phonetic loans); (5) *xingsheng* (phonograms); and (6) *zhuanzhu* (derivatives), according to Wang (1981). *Kangxi Zidian* listed 47,035 Chinese logographs and *Zhonghua Da Zidian* 48,000, according to Professor S. H. Zhao (1992, p. 17) of Jiaotong University in Shanghai. Contemporary Chinese consists of more than 24,235 logographs, with 90 percent of them being phonograms, seven percent ideograms, and three percent pictograms (Wang, 1981, pp. 231-232; Tien, 1983, pp. 13-15).

Mandarin is a Peking dialect that has been adopted as *the* official spoken language (*guanhùa*) of both the People's Republic of China (PRC or China) and the Republic of China (ROC or Taiwan) to represent written Chinese. (Peking, which literally means "the Northern Capital or Palace" and is now commonly known as Beijing, had been chosen by a number of Chinese emperors as the capital city in several dynasties of the Chinese history.) It is not uncommon to find that: (1) There are gaps between sounds and script in Chinese in that there are pronounceable syllables (such as *GIN*, *KIN*, *KING*, *JA*, *JAN*, *JAO*, *QA*, *QAN*, *TEN*, *TO*, *TON*, etc.) that have no corresponding written characters and that there are possible graphemic constructions that are not accepted as Chinese characters at all; (2) Some Chinese characters have several sounds (*pòyinzì*) within the same dialect when they are used for reading and for conversation; (3) There are numerous homophonous characters; and (4) Homophones in one dialect may not serve as homophones in another. Briefly put, a standardized written text form, either complex text (CT) or simplified text (ST), is used to correspond to any spoken languages or dialects.

2.2 The Inscrutable Chinese: Some Controversies

As stated earlier, reading behavior can be divided into three categories according to types of sensory processing involved as visual-based (silent reading), oral-based (sound reading), and tactile-based. This study focuses largely on visual-based processing.

As far as reading is concerned, related issues may be placed under two categories: (1) Readers' text processing strategies (Chu-Chang and Loritz, 1977; Tzeng, Hung, and Wang, 1977; Tsao, Feustel, and Soseos, 1979 among others), and (2) the representational systems embedded in the text, such as the graphemic representations in complex versus simplified texts (DeFrancis, 1975; McCoy, 1975; etc.) and phonological representations in *zhuyin, pinyin*, and romanization (DeFrancis, 1975; Laychuk, 1983; Everson, 1988). The first category concerns reader's knowledge and strategies in decoding L1 and L2 texts, and the second text materials.

2.2.1 Text Processing: L1 versus L2

Background knowledge (BK) plays an essential role in decoding messages (Anderson and Pearson, 1984). The role of BK in language comprehension has been formulated as *Schema Theory* (Thorndyke and Hayes-Roth, 1979; Carrell and Eisterhold, 1991). Text comprehension is considered an interactive process between the reader's BK and the text (Carrell, 1988a, 1988b; Carrell and Eisterhold, 1988). In L1 acquisition, the learner's task is to gradually establish the relationship between words and meanings, as Pearse, Gleason and Pan (1989) have pinpointed:

> The acquisition of words, their meanings, and the links between them does not usually happen at once. During the course of this process, which is called semantic development, children's strategies for learning and relating them to one another change as their internal representation of language constantly grows and becomes reorganized. (p. 101)

But, will representations be the same across languages, or language-specific? For example, Chinese speakers will see meaning in the way the following numbers are ordered that non-Chinese will not see.

(2.1)	2	3	4	5	(*er*	*san*	*si*	*wu*)		
	6	7	8	9	(*liu*	*qi*	*ba*	*jiu*)		
(2.2)	1	2	3	4	5	6		8	9	10

In (2.1), number ONE (*yi*) is missing in the first row, and number TEN (*shi*) in the second. *Yi*, meaning 'one,' is a homonym of 'clothing,' and *shi*, 'ten,' a homonym of 'food' in Chinese. A family without *yi* and *shi*, basic needs in life, will suffer from coldness and hunger, therefore, will lead a miserable life. People in Taiwan use (2.2) to denote a city in Central Taiwan, *WU-QI*, or its homophonous counterparts, meaning either 'without wife' or 'my wife.' While the above numeral contexts do not make sense to non-Chinese speakers, the icon-based rebus representation of an "eye" plus a "deer" for "idea," as elicited in Tzeng and Hung (1981, p. 237) and Fang, Tzeng, and Alva (1981, p. 609), does not make sense to non-English speakers either.

And BK may affect readers' interpretation and comprehension of texts when, for example, Chinese have more than thirty words to express various ways of cooking or food preparation (see Chef Pei-Mei Fu's *Cookbook*) and Eskimos have nearly a hundred words for different types of *snow* (Restak, 1988, p. 222). The need to describe such differences in lexical or memory schemata seemed to reflect subjects' BK about, experiences of, and interactions with, the world,

which varies from area to area, and from culture to culture. (Thorndyke and Hayes-Roth, 1979)

Even when languages of the same families normally share some common similarities morphologically, semantically, syntactically, or phonologically, there are difficulties. English, German and Dutch are members of the Flemish language family. German *Haus* is English *house*. The English verb *make* corresponds to *machen* in German, and *maken* in Dutch. Such similarities are easy to trace. Japanese, Korean, and Vietnamese have "loan words" from Chinese, but have adopted their own writing systems. Japanese high school graduates have to learn about some 1500 *kanji* characters ("Chinese characters," or *hànzì*) (Koda, 1986). While kanji characters look "identical" to Chinese readers, they may have either retained original "Chinese" meanings or undergone semantic variation over the past several centuries. A Chinese reader, without adequate BK in Japanese, will not understand Japanese texts even if he "recognizes" every word of them. Consider the following true stories (2.3 and 2.4), in which misinterpretation of text and even best wishes for prosperity (see Figure 2.1) both ended in embarrassment.

(2.3) A group of Chinese traveled to Tokyo, Japan. At night, they strolled in the downtown area, shopping in department stores, drinking and enjoying themselves in a night club. One their way to their hotel rooms, two guys saw a banner hanging in front of a "store" with a big "Chinese" character *TANG* on it. They thought it might be a "snack bar" serving some kinds of special "soups," but it turned out to be a *SANTO,* "public bathroom."

(2.4) A Chinese gave his Japanese friend a gift, a silver plaque with the engraved wording *JIN-YU-MAN-TANG*, a wish commonly used by Chinese for prosperity, meaning "May your home be filled with *gold* and *jade*." His Japanese friend replied a week later: "Home is inappropriate to be filled with *testicles*." [Apparently, *JIN* ("gold") and *YU* ("jade"), symbols of

wealth in Chinese culture, are perceived as a Japanese word compound *KINTAMA*, 'testicles' or literally, 'golden balls.']

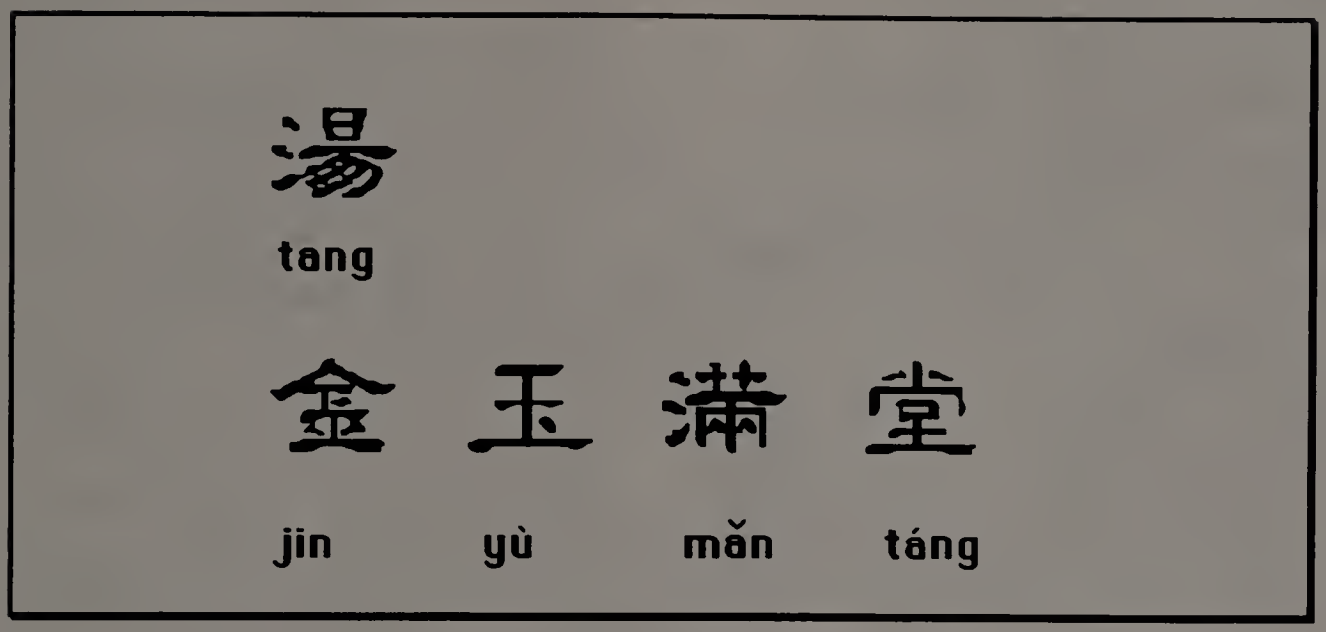

Figure 2.1 Chinese hanzi versus Japanese kanji.

Likewise, a postal parcel that I sent to a friend in West Germany in 1971 and marked with English word "GIFT" was opened for inspection by the Deutsche Bundespost officers because they suspected that the contents inside was "poisonous stuff or a drug," since the word *Gift* in German means *poison*. That illustrates that in text comprehension a reader tends to use his BK as primary resources to make hypothesis about "possible word meanings" (Nagy and Gentner, 1990). In unfamiliar contexts or environments, a reader's comprehension tasks could be even more difficult. Consider the following case:

(2.5) My neighbor once led a tour of a group of Taiwanese senior citizens to several European countries years ago. Since none of his companions had ever learned any European languages, he taught them a simple way to distinguish a "men's room" from a "lady's room": the shorter word on the door is for "MEN" and the longer word for "WOMEN." His strategy soon faced a challenge when they ran into the rooms displaying "LADIES" and "GENTLEMEN" on the doors.

German texts printed in Fraktur style are more difficult to recognize, hence will result in slower speed of reading, than those printed in regular or standard typeface, just as texts in original Hebrew, Thai, or Mongolian scripts are more difficult for nonnatives to "read" than their syllabic transcripts. Should we consider identical texts printed in various styles as the same in terms of language content or as different in terms of graphemic representation, when readers are still reading the same messages? Foreigners normally have difficulties in correctly pronouncing Chinese names and terms in *pinyin* or other *romanization systems*. [It is typical to find examples such as that the "*I*" in *I-Ching*, (spelled as *Yi-Jing* in pinyin,) the *Book of Changes*, was mispronounced as "*eye*" by a hostess in the *Beyond 2000* program on the Discovery channel.] Chinese may encounter mixed standards in transcribing their names into English orthography. As a result, Chinese family names may appear differently to different English correspondents. *Woo*, or *Wu*, could be the same as *Ng*, and *Lin*, *Lim*, and *Lam* are the identical family names in Chinese. *Chen*, *Chin*, and *Tan* could represent the same or individually different surnames in Chinese, depending upon the dialects used for phonetic transcription. Texts can become confusing when they are perceived and processed by various RSs.

2.2.2 Lateralization: Hemispheric Battle of the Left and the Right

The pictographic construction of Chinese script, as well as Japanese Kanji, has led researchers to assume that in reading Chinese and Kanji, the right cerebral hemisphere is preferentially more involved in information processing than the left (Sasanuma, 1974 and 1975; Hatta, 1977; Biederman and Tsao, 1979; Tsao, Feustel, and Soseos, 1979; Tsao, Wu, and Feustel, 1981; Fang, Tzeng, and Alva, 1981). Their common stance is that characters are pictorial symbols, so reading Chinese and Kanji invokes visual recognition in the right hemisphere. However,

Professor William S.-Y. Wang of the University of California, Berkeley has come up with different findings. He explained:

> There are numerous languages in the world, called tongue or tonal languages, that use the pitch of the voice as part of the intrinsic form of each word. For instance, the word *ma* can mean 'mother,' 'hemp,' 'horse,' or 'to scold,' based on the pitch at which the segments are pronounced. These differences are based on the frequency of the vibration of the vocal cords... (quoted in Restak, 1988, pp. 220-221)

As pitch variations in Chinese sound almost like music to western ear, one might expect that Chinese, like music, would be processed in the right hemisphere. But in actuality, the Chinese language is processed the *same* way as in English: in the *left* hemisphere of all right-handers and the great majority of left-handers, according to Wang's studies of the effects of brain damage on language in adult Chinese [*italics* mine]. Wang confirmed that,

> Both the tones of spoken Chinese and the pictorial characters of the Chinese writing system are strongly lateralized to the left hemisphere. Patients with damage to the left hemisphere have greater difficulty spontaneously producing Chinese characters in their writing....For instance, if something is drawn that looks like a Chinese character but isn't, left-hemisphere damaged patients experience no difficulty in copying these fake characters [i.e., the components are those of a Chinese word, but they don't really form a word]. Their difficulty is with real Chinese characters....This indicated that the Chinese writing system, even though it is based on a different principle—each graph typically refers to both a meaning and a phonetic syllable—lateralizes to the *left* hemisphere by its being linguistic. (in Restak, p. 221)

As Restak (1988, p. 221) has concluded in his book *The Mind*: "In all languages that have been examined to date, the human brain is organized to distinguish linguistic from nonlinguistic stimuli. This holds true even in languages that have strong pictorial and musical qualities."

In broadest sense, logographs and alphabets are symbols of different shapes. Arabic, Greek, Hebrew, Russian, and some other languages have their own symbol systems, which can also be represented in Roman alphabet. Will a specific kind of graphemic constructions or RSs require one of more processing load in reading? This study tries to answer this query.

2.2.3 Complication versus Simplification: Reinventing the Text

While there are numerous dialects spoken and used in both China and Taiwan, there are concurrently only two written forms, namely: Complex text (CT, or *fantizi*) and simplified text (ST, or *jiantizi*). CT, also known as traditional style, is an improved version of the "original" text, which has been used since ancient China millennia ago. ST, as reformed and advocated by the Central Government of the PRC since 1956, is essentially a reconstructed form based on the complex text to promote literacy acquisition among farmers, workers, and soldiers of the nation (Cheng, 1975, p. 213). Some 2,500 characters with multiple (10 or more) strokes have already undergone a "face-lift" by being truncated into or substituted with simpler ones (refer to Cheng, 1977, for examples). More are expected to be introduced. Hence, the number of strokes for writing most characters is significantly reduced.

The choice of learning either CT or ST or both has opened another battlefield. Some insist on learning and teaching CT for two reasons: (1) CT retains the root of the character (Leong, 1977); and (2) ST causes visual confusion (Zhou, 1961; cited in Cheng, 1977, p. 322). However, some oppose

CT due to the criteria that (1) ST is easier to learn in terms of visual recognition and writing; and (2) ST is more efficient in encoding (Cheng, 1975). Cheng remarked:

> ...about 90 percent of Chinese characters consist of phonetic components. However, due to phonological changes and other innovations these phonetic components may not reflect current phonetic reality. Those characters which have correct phonetic indicators may be complex in shape. Simplification of characters by use of simpler phonetic components should prove to be productive....Apparently, such simplification is a move toward phoneticization of the writing system. (pp. 215-216)

Cheng suggested that it would be appropriate to introduce ST for beginners and then CT later, so beginning readers of Chinese would be able to first develop the basic skills with ST for general purposes and the advanced skills with CT for reading numerous publications in CT later. Cheng (1977, p. 335) analyzed,

> ...because of language reality our students [Americans learning Chinese as a foreign language] need to know both the complex and simplified characters. The pedagogical decision we need to make is therefore not which set of characters should be taught, but rather how we teach them. DeFrancis (1975) believes that it is simpler to convert the complex to the simplified. This feeling is generally based on the experience of those who learned the complex forms first. But the 'cost' of conversion should be balanced by the initial difficulty of learning the complex characters. The initial difficulty is especially weighty for our students, who generally have a quite different language background. As they come to take Chinese, they face these three extra dimensions of learning in comparison with their study of a language in the European family: (1) the addition of tones, (2) the lack of cognates in the lexicon, and (3) a non-alphabetic writing system. Thus at this initial stage it is pedagogically important to reduce the difficulty of learning.

If ST is believed easier to learn, then has the illiteracy rate in the PRC ever declined to justify the advantages of using ST over the past three decades? We can never know when the next wave of ST reform will take place, when language reformers in the PRC simply reinvent the text by introducing new rules of simplification and make the old versions of ST obsolete, whereas CT continues to persist as is. And I wonder whether it is worth the investment of time and efforts for L2 learners of Mandarin Chinese in learning both CT and ST, when it comes to recognizing and/or writing the two sets of some 7,000 commonly used characters (Zhang and Simon, 1985, p. 193) in order to appreciate Chinese literature. Is there any suggestion that native speakers will process texts represented in ST and in CT differently? Experiment I of this study intends to answer this question.

2.2.4 Romanization: When Not in Rome, Do as the Romans Do

Romanization is a process of using the Roman alphabet to represent the sounds of Chinese characters. Four romanization systems are commonly used: the Thomas Wade (Wade or Wade-Giles) system, the Yale system, the Kwoyeu Romatzyh, and Pinyin. Zhuyin fuhao, also known as Mandarin Phonetic Symbols (MPSs), consists a set of 37 symbols taken from parts of Chinese characters to represent Mandarin sounds. [There are four extra symbols to represent sounds barely used in the Mandarin but frequently used in regional dialects such as Cantonese (*Guangdonghua*) or Hakka (*Kejiahua*).] Zhuyin fuhao constitutes neither an alphabet- nor a character-based symbol system, hence serves as an independent RS. Comparison charts showing the representations of Mandarin consonants, vowels, and tones in the five aforesaid PTSs (i.e., MPS, Pinyin, KR, Wade and Yale) are attached as Appendix A.

There are several sounds unique in Mandarin and not found in English such as retroflex fricatives *zh-* and *q-*, as in *zhan* 'to stand; station,' and *qu* 'to bend; to take; to go' in pinyin, which are respectively represented as *j-* and *ch(i)-* in the KR and Yale systems, and *ch-* and *ch'i-* in the Wade system. This study does not intend to investigate which PTS is the most "efficient" in learning Mandarin by contrasting and comparing groups of students learning each PTS. Since when a language is represented in other ways, the rules for representing the language are always devised, specified, and applied. The learners are then liable for discriminating the subtleties in the RS they choose to learn and use. Ironically, when it comes to publishing text books in pinyin for elementary schools, publishers in the PRC have not completely complied with pinyin orthography recommended by the Chinese Language Reform Committee, Chen (1991) so indicated. Does that imply that pinyin orthography is not as easy to learn or that pinyin has underlying deficiencies in representing written Chinese? This problem will be investigated later.

Chinese script, as reflected in numerous literary works published in the pre-simplified-text era of the 1960s, is traditionally presented from top-to-bottom and from right-to-left. An alternative way of text presentation from left-to-right and from top-to-bottom, as English text is, is adopted primarily for scientific papers with formulae and equations after the movements of romanizing the Mandarin. Is a romanization system such as pinyin better than zhuyin, and if so, in what aspect? If the Chinese language can have several PTSs to represent the sounds of its characters, then the central issue, I assume, lies not in which system is more effective when it comes to learning. Phonetic symbol systems are devised only to help represent as precisely as possible the existing sounds, whether or not learners are able to learn. What correctly represents sounds is not the symbol system, but rather, the knowledge about what the symbols are

meant to represent, i.e., the "signified" information (Jackson, 1991), and knowledge about the associated behavior to be involved in correctly producing the sounds or "sound patterns." For new learners of any Chinese PTSs, symbols are just learned to match the sounds in their mother tongues they have acquired or what they are now learning anew. Over the past decades, we have seen a transition, as well as a fashion, from competing romanization systems to the preferred pinyin orthography in addressing "Chinese issues." Proper names such as family names and place names have been recoded as different textual representations, which interested nonnative speakers of Mandarin Chinese and native CSL teachers have to either relearn from scratch or update their existing bodies of knowledge. For instance, Beijing is formerly Peking, and Chungking is now Chongqing. The next section discusses the gaps between representations in characters and in pinyin.

2.3 Transformation: From Representation to Presentation

Since a language may consist of morphological, phonological, semantic, syntactic, and pragmatic components (Flynn, 1988b), a lexical item can be analyzed and decoded from any of the components or channels of meaning expression. If we assume that human language skills be acquired in the "natural order" of listening comprehension, speaking, reading, and writing, then we may infer that knowledge about the phonological system of a language is acquired before that of the graphemic system when one learns to speak before one learns to read and write in L1. An isolated lexical item basically contains graphemic (*zixing*, or 'word form'), phonological (*ziyin*, or 'word sound'), and semantic (*ziyi*, or 'word meaning') units. Nevertheless, it is not impossible that speakers of some regional Chinese dialects know only the phonological and semantic units but not their graphemic correspondents. It is apparent that some phonemes in

Cantonese or Hakka have no (or unknown) corresponding Chinese characters. As Tien (1983, p. 5) stated, "Chinese symbols are visual manifestations of original ancient metaphors which are nowadays forgotten and no longer traceable." Therefore, in some Chinese newspapers readers may find characters that are specifically reinvented to represent Cantonese sounds, such as the character *mou*, 'to do not; to have not' is taken from part of the character *you*, 'to have' (see Figure 2.2).

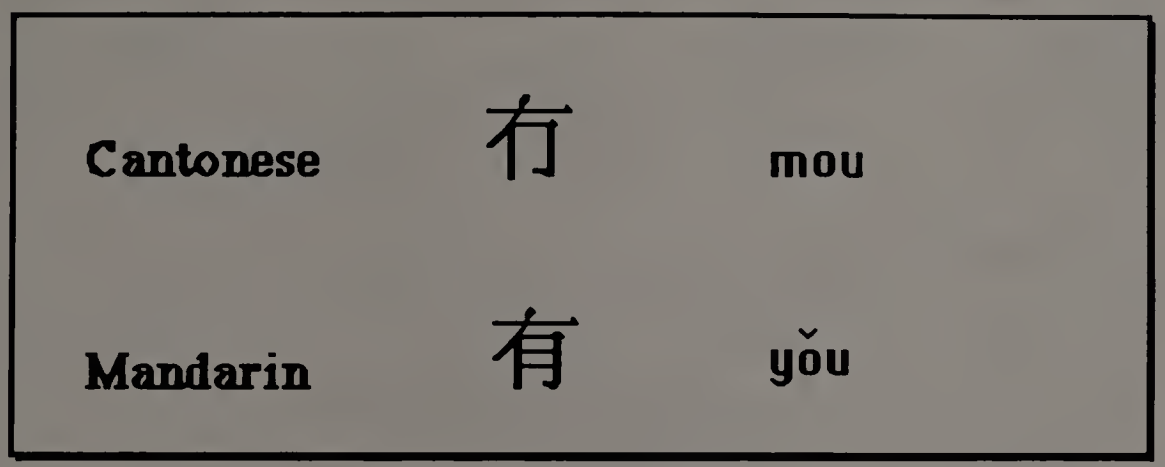

Figure 2.2 Cantonese derivative *mou* from Mandarin *you*.

Research on Chinese language learning, particularly in area of word recognition, falls almost exclusively within the three major categories, as observed, for instance, by Chu-Chang and Loritz (1977), Tzeng, Hung, and Wang (1977), Biederman and Tsao (1979), Zhang and Simon (1985), Everson (1986 and 1988), Hayes (1987a and 1987b), and Perfetti and Zhang (1991). Those basic components provide some clues for lexical access. Some of the studies that examined this issue are noted in the following sections.

2.3.1 Nonword Experiments: Making Sense out of Nonsense and *Vice Versa*

Several studies on reading texts were into nonword experiments. A reader's first encounter with reading is the visual-based information processing of printed text, symbols, colors, shapes, and so on. Visual processing involves feature extraction, letter identification, stroke-pattern integration, logographs construction, word recognition, comprehension, etc. (Chang, Hung, and Tzeng, 1992, p.122). Individual words or characters are the basic units to form meaningful text of various lengths. A number of researchers have undertaken experiments concerning non-sense words, or nonwords (e.g., Horowitz, 1967; Press, 1975`; Anderson and Freebody, 1982; Koda, 1986). Subjects were asked, for instance, to match pictures with words, or make judgment of similarities between objects (Press, 1975), such as a sentence containing a nonsense word *bork* as in *"This is a bork"* is to match a corresponding picture showing a *bork*. Experiments on nonsense syllables has a century-long history. In 1894 Müller and Schumann found that more time was needed to relearn nonsense syllables (cited in Stroop, 1935, pp. 643-644). Such experiments normally provided evidence that rules already learned in previous settings, i.e., "memory schemata" (Thorndyke and Hayes-Roth, 1979), could be applied or transferred to unfamiliar circumstances, and passages consisting of uncommon events or unknown vocabulary are the most difficult to comprehend (Pace, 1980). To illustrate, testees are asked to demonstrate their knowledge about the regular and irregular plural forms of an English noun by responding respectively with *borks*, *mice* and *houses* in (2.6) - (2.8):

(2.6) This is a bork. There is another bork. Now, there are two ____.
(2.7) This is a mouse. There is another mouse. Now there are two ____.
(2.8) This is a house. There is another house. Now there are two ____.

But, it is noteworthy that English vocabulary contains a significant portion of "imported" (i.e., *loan*) words from other languages (such as *Zeitgeist* and *Weltanschauung* from German; *sanpan*, *kow-tow*, *rickshaw*, and *typhoon* from Chinese or Cantonese) and that new words are coined each year, which may bear their etymological origins from either Latin or Greek or are re-fabricated texts (such as *edutainment* from "education + entertainment" and *infotainment* from "information + entertainment," but not yet *seducation* from "sex education"). We may consider proper names, trademarks, certain titles of journals or magazines, fanciful characters in children's books or novels, as nonwords. Eventually, trademarks and proper names can have their second meanings, if they have been extensively used to designate something. Xerox, diesel, guillotine, volt, and watt are some examples. Similarly, the name of the journal *Semiotica* suggests its relationship with semiotics that bears a Greek origin of *sema* (sign). Should we argue that Micky Mouse, Snow White, Pinocchio, Bugs Bunny, Yosemite Sam, and Peter Pan are also nonsense utterances which happen to come "alive" with repetitious reruns of their cartoon shows produced in the 1940-50s or with the "magic kingdom" built after them? And how about *pomato*, a newly genetically-engineered breed that bears both potato and tomato? The above instances suggest that nonsense words or nonwords still have a fair chance to "make sense," just like fictitious characters in Greek mythology, should the contexts they have been built-in become widely acknowledged.

Consider the following nonword or pseudo-word examples, such as the wording on the package of Quaker's cereal (2.9), store names as (2.10) and (2.11), which bear a phonetic resemblance to their orthographic counterparts,

and terms used in a newspaper (2.12), in a book (2.13), in computer magazines (2.14-2.17), and in a movie (2.18). I think, those words reveal a creative usage of the language. They, just as the nonsense words in the researchers' experiments, could have potential risks of providing readers with "negative" feedback.

(2.9) Extraoatinary crunch, Extraoatinary taste, Extraoatinary cereal (Quaker's cereal)
(2.10) Gentlemen's Wearhouse (Store near Boston, Massachusetts)
(2.11) KwikPrint
(2.12) Newsline, Moneyline, Lifeline (Section titles of *USA Today* newspaper)
(2.13) Around the World in 80 Words (Book by Charles Berlitz)
(2.14) Around the World in 80 Megabytes (*MacUser*, 4/92, p. 198)
Around the World in 80 Mouse Clicks (*MacWorld*; 8/92)
(2.15) Know Your Writes (*MacUser*, 2/92, p. 254)
(2.16) Ware and Tare (*MacUser*, 1/92, p. 41)
(2.17) The Write Stuff (Title of a computer program)
(2.18) The Right Stuff (Title of a book by Tom Wolfe and of a movie)

Nonwords might make sense, whereas words that normally make sense might yield anomalies in some contexts. Each sentence in dialogues (2.19) - (2.21) is grammatically fine, but the combinations of the two make the contexts peculiar.

(2.19) A: I love you.
B: You're welcome.
(2.20) C: I love you.
D: No, thank you.
(2.21) E: Good morning, how are you doing?
F: Are you all right?

One will require BK in specific fields to decode the following messages.

(2.22) This is a five-star restaurant.
(2.23) This is a four-diamond hotel.

(2.24) This product has a 4 1/2 mice rating. (*MacWorld*)

(2.25) This movie is two thumbs up. (*Siskel & Ebert*)

(2.26) Technology has conquered space—the space between your teeth.
(TV commercial for InterPlak ®, a teeth-cleaning apparatus)

(2.27) Have you seen my roommate I bought yesterday?
(Roommate ®, a room deodorizer)

(2.28) Have you taken my poison?
(Poison ®, a brand of cosmetic)

(2.29) I cannot stand your obsession.
(Obsession ®, a brand of perfume)

(2.30) Our sales reps will demo new windows apps. Best time for Windows shopping.
(Windows ™, a trade mark of Microsoft Corporation.)

[*N.B.*: Commercial connotations are not intended.]

Similarly, sentences (2.31) and (2.32) may generate various levels of acceptance. Answers for the question (2.33) may vary considerably.

(2.31) On the bus to our field trip, our teacher told us a story that was *ten-mile*-long.
(Adapted from *Reader's Digest*. The ten-mile reading was based on the odometer)

(2.32) Last night, I had a *three-page* dream.

(2.33) Question: How old are you?

Answer 1: I am three-month old.
(It must be *ein Wunderkind* to speak at that age!)

Answer 2: I am 42 years, 10 months, 2 weeks and 5 days old.
(Would it be even more accurate up to the second?)

Answer 3: I am 13, but become 10 when going to the Disney Land.
(Honey, you have shrunk the kid--by age?)

To sum up, there are gaps between pronounceable syllables and words that are adopted for actual use. Today's nonwords or pseudo-words may become tomorrow's daily vocabulary, such as *educationese* (Goodman, 1992, p. C16), *featuritis* (Swaine, 1992, p. 43), *legalese*, *motherese*, and *premierese*. In medical science and biology, numerous Latin names are used for each species of plants, insects, and animals that most people will have difficulties to memorize. With the advancement and popularity of high-technology, the computer industry has

become a community notorious for its *computerese*, another field of RS worth exploring. Maybe everyone has to update their mental lexicon when computer jargons like GUI (graphical user interface), 30-day MBG (money back guaranteed), NCP (not copy-protected), SCSI (small computer system interface), WYSIWYG (what you see is what you get) have become daily-use vocabulary to technologists and appear extensively in reading materials from newspapers to other publications for general audience. The boundary among non-words, pseudo-words, and standard vocabulary could someday become blurred.

2.3.2 From Syllabaries to Logographs—The Search for a Memory-Resident System

Writing systems, as stated in Chapter One, can be represented in logographic, syllabic, and alphabetic characters, as shown in Figure 2.3. All of these can represent Chinese.

Categories	Representative examples
Logographs	
	Chinese characters (Hanzi)
	Japanese Kanji
	Korean Hangul
Syllabaries	
	Zhuyin fuhao (MPS)
	Japanese Kana
Alphabets	English & alphabetic languages
	Pinyin & romanization systems

Figure 2.3 The three categories of linguistic representations

Logographs represent written form or the script, whereas alphabets represent the sound or the speech. Syllabaries lie in between in that they can represent sounds in one way while constituting its own writing system in another. In Chinese the relationship between script and speech is not very close and in most cases the script may provide inconsistent clues to speech (Tien, 1983; Hayes, 1987a & 1988). Korean can also be represented in Chinese characters (hangul), but has its own writing system. As Wang (1981) has observed,

> Of all the writing systems, the Korean script probably comes closest to a feature representation of speech. Furthermore, the shapes of some hangul letters had been designed to mirror the corresponding shapes of the tongue during articulation....Another unusual aspect of hangul is the way in which the letters are stacked together. Although the hangul letters constitute an alphabet, they are not written in successive frames as in most alphabetical writings. Instead, like a syllabary, each frame contains a syllable, which in term is constructed in different ways according to the shapes of the various hangul letters. Hence, the script is at once a syllabary (in that its frames correspond to syllables) and an alphabet (in that its letters correspond to segments). (p. 227)

Among the three written systems, is one system more efficient than others in reading in terms of speed and memory trace? Will texts with contextual clues differ from those presented in isolation? The following paragraphs examine Hayes and Tien's studies that dealt with these questions.

Hayes (1988) assumed that, "...the predominant processing would reveal itself through the types of errors that subjects made on the tests" (p. 188). Since, in his experiments, NSs made significantly more phonological errors than NNSs did at the word level, so Chinese natives tend to predominantly use phonological strategy in recalling non-contextualized stimuli (i.e., isolated words). I suspect more errors in one strategy might be due to the incompetence in applying that

strategy, just like an unskillful (or careless) typist would normally make more typing errors at average typing speed. Or, could the results be affected by other factors, such as using RS *pinyin* or *zhuyin* rather than Chinese texts?

We are unaware of the language background of the Taiwanese subjects in Hayes' experiments, therefore, we are unable to tell whether the phonological errors they tended to make more than the nonnatives (Americans) were attributed to the induction of Mandarin or other dialects. In Taiwan, a majority of people are capable of *speaking* at least two languages (Mandarin plus one regional dialect) in the multilingual and multicultural society, as reflected in subject information in this study (see Chapter Three). No matter what dialect one speaks, one standard written system of Chinese (i.e., complex text) is used. Given the account of Mandarin being the dominant spoken language of the Chinese people, potential dialectal diffusion other than Mandarin could be minimal, since other dialects appear comparatively much less than Mandarin in international linguistic literature. [For instance, Cheng (1985) used two separate PTSs to represent sounds of Taiwanese and Peking Mandarin.] However, almost half (seven out of 15 pairs) of the phonological distractors that Chu-Chang and Loritz had intentionally deployed in their experiment might have been eliminated in Hayes' test due to the diversity of language background demonstrated by the subjects. That is to say, Hayes' findings from the word-level test in Experiment I could be invalid.

Experiment I contains examples of less frequently used characters, such as *BU* (obituary), *CHOU*, a polysemous character, whose meaning will be determined by the bounded contexts, such as *xiaochou* or *choujiao* (clown, zany), *yichou* (a chronological order used since ancient times by Chinese farmers as in farmer's almanac). Chu-Chang and Loritz's subjects were native speakers of Cantonese with proficient skills in reading and writing Chinese. I doubt

whether the American subjects (nonnatives), though with proficient reading skill in Chinese as claimed, could read or recognize these less frequently used characters, which would result in unpredictable performance. That might explain the finding that NNSs made more graphic errors on word-level recognition test.

Sentences used in Experiment II seemed to use examples of *spoken Chinese* or *plain Chinese* (*Putonghua* or *Baihua*). Three types of distractors, phonological, graphic, and semantic, in Experiment II, seemed to construct "graphemically anomalous" examples, which Chinese natives can easily identify. The single-character phonological distractor, *HU* for example, has evolved into a nominal compound in modern Chinese, such as *huli* to denote 'fox' and *hubo* 'lake.' Hayes' examples of two types of "control sentences," such as (2.34) and (2.35), involved the judgment of true-false values of the statements. As a result, a language test on word recognition became a test of one's *common sense*. If people have diverse standards in value-judgment, then true-false statements like (2.36) and (2.37) could be disputatious.

(2.34) *Jiu shi yizhong yinliao.* (Wine is a kind of drink.)
(2.35) *Bei de fan fangxiang shi dong.* (The opposite of North is East.)
(2.36) Tomato is a kind of fruit. True or false?
(2.37) The opposite of white is black. True or false?

Tien (1983) had discovered in her comparative study of the reading behaviors demonstrated by 10 Chinese adults involved in reading both alphabetical (English) and non-alphabetical (Chinese) materials that there were no fundamental differences between readers of English and Chinese as far as the basic reading is concerned.

Tien's subjects were bilingual adults and Tien, and Chang, Hung, and Tzeng (1992) all focused on sound reading. I assume that reading behavior and text processing in sound reading is different from that in silent reading. First, readers have to visually perceive the texts, encode them and then convert them into aural output. Next, in converting the aural stimuli readers are retrieving information from existing mental lexicon by applying old or trying new rules, as in several non-word experiments. Third, being able to pronounce "correctly" means the acquisition of not only the knowledge about and the awareness of the differences in the phonemes that constructs the words but also the skillfulness in reproducing sounds involving appropriately controlled behaviors or movements of the oral organ. Fourth, reading the texts in a "meaningful" way requires readers of the knowledge and ability to identify texts and analyze them syntactically and semantically. Phonetic features such as tones, pitch, stress, speed of the speech, which assign various meanings to texts, remained unspecified in Tien's and Chang, Hung, and Tzeng's experiments. Chu-Chang and Loritz's subjects performed bilingual processing of isolated texts (i.e., vocabulary only) visually presented for STM. The ways readers confronted texts in sound reading and in slide presentation could be an experience of differing demands as well as tasks in information processing. Will the ways texts are presented affect readers' comprehension? To what extent various RSs can affect native and non-native readers remains unclear. This exploratory study is intended to find clues that may suggest answers to this question.

2.4 Summary

This review has explored a number of concerns about (1) various approaches to the processing of reading texts, such as visual-, oral- and tactile-based reading; (2) different demands in processing visual-based texts, such as silent reading and

sound reading; (3) encoding strategies used in processing visual-based Chinese texts presented in isolation and with contextual clues, such as graphic, phonological, and semantic encoding; and (4) three representational systems for Chinese, namely, alphabetical (pinyin), syllabary (zhuyin), and logographic (characters).

Current studies have shown different encoding strategies between NSs and NNSs, but the factor of the benefit or efficiency of using the three RSs in learning Chinese has remained unexplored. Since achieving proficiency in reading logographs is the final goal in learning Chinese, this dissertation will explore how and to what extent each individual RS will affect the processing of Chinese texts by both native and non-native speakers.

CHAPTER 3
METHODOLOGY

This chapter has three sections. Section one of this chapter provides a short introduction to the research questions. Section two presents factors under exploration and conceptual hypotheses. Section three describes the methodology of two experiments designed for this study.

3.1 Introduction

This study tries to answer the following two questions:

1. Will specific representational systems make any difference to native speakers in comprehending Chinese texts in terms of accuracy and speed? And
2. Will a specific representational system differentially affect native and non-native speakers in comprehending Chinese texts in terms of accuracy and speed?

To answer these questions, native speakers of Chinese from both China and Taiwan and non-native learners in the United Stated of America will be given two tests of Chinese vocabulary, isolated and contextual texts in pinyin and in characters (in complex text version). As testees' reactions to the tests are of equal concern as their test results in this study, an interview with the testees or a survey will be conducted to better understand their reactions and language background.

3.2 Factors, Test Design, and Conceptual Hypotheses

In a picture-word experiment, Rusted (1988) found that Chinese logographs provided more rapid access to meaning in terms of processing Chinese script. The finding seemed to imply that texts of Chinese expressed or represented in various forms or styles affect the results in text processing. Chu-Chang and Loritz (1977) discovered that Chinese ESL learners encoded Chinese ideographs phonologically and encoded English words visually. Tien (1983) found that bilingual Chinese demonstrated no significant difference between reading Chinese and reading English texts. Hayes (1987a and 1988) assumed that Chinese tend to predominantly use phonological strategy in recalling Chinese characters at the word level due to the more phonological errors being made. If Chinese predominantly encode ideographs phonologically, will then phonological representations of Chinese ideographs, i.e., pinyinized texts, be encoded the same way by Chinese natives and non-natives? This study attempts to verify Hayes' findings and proposes two conceptual hypotheses.

Native Chinese from Taiwan learn zhuyin before acquiring the literary skill of reading complex text (CT), while Chinese from China learn pinyin, a romanization system, before acquiring literary reading skill of simplified text (ST). According to my interviews with six natives from China, Chinese Mainlanders have to learn CT if they want to read the literary works published decades ago. Literate adults of ST normally have fewer or no difficulty in reading complex characters, but have difficulty in writing them. Though CT is the official standard in Taiwan, a restricted number of simplified characters are still allowed in unofficial documents. As Taiwanese students learn predominantly zhuyin fuhao, most of them are unable to read or write ST, which

is the national standard in China. Due to my own limited competence in reading and writing ST, the tests do not include ST version.

Two factors to be examined in Experiment I are: (1) Text representations in pinyin and in characters, and (2) native speakers from Taiwan and China, as shown in Figure 3.1. Most Taiwanese generally use a romanization system other than pinyin, with the exception of those in the field of Chinese linguistics. Experiment I intends to determine how and to what extent can an unlearned RS, marked X in the two-by-two matrix in Figure 3.1, affect native readers.

	Native (Taiwan, ROC)	Native (China, PRC)
Pinyin	X	
Characters		X

Figure 3.1 Factors matrix in Experiment I

In Experiment II, the same factors will be analyzed but zhuyin is added to replace pinyin for the Taiwanese group only, and a third group of non-native readers is added.

	Native (Taiwan, ROC)	Native (China, PRC)	Non-native (USA)
Pinyin	N/A	X	X
Zhuyin	X	N/A	(optional)
Characters	X	X	X

Figure 3.2 Factors matrix in Experiment II

As native speakers of Chinese will presumably demonstrate better performances, both in speed and accuracy, in reading texts represented in an RS they have already acquired than in an RS they have not learned, two conceptual hypotheses are proposed for Experiment II:

1. Native speakers of Chinese will demonstrate better performance than non-native speakers in comprehending texts represented in Chinese characters in terms of accuracy and speed.
2. Non-native speakers of Chinese (American students, in this study) will demonstrate better performance than native speakers in comprehending texts represented in pinyin in terms of accuracy and speed.

Two tests (see Appendices B and C) are designed to explore the above two hypotheses. The tests intend to find whether there will be a more efficient system in processing Chinese texts in logographic as opposed to alphabetic representations for natives and nonnatives, and whether various representations of the same texts affect the processing load. Hypothesis I is proposed based on the assumption that Chinese natives tend to process more efficiently with the current RS they predominantly use, contrary to Hayes' aforementioned assumption. Hypothesis II is proposed based on the assertion that the closeness in the category of RS with the first language will contribute to the effectiveness in processing foreign texts represented in the same RS. Following sections briefly describe the design of tests, the tasks of subjects, procedures of data collection, and data analysis.

3.3 Methodology—Subjects, Procedures, and Data Gathering

Subject information and intended procedures in two experiments are explained underneath respectively.

3.3.1 Experiment I—Survey I

Subjects, instruments, procedures of test administrations, data gathering methodology and scoring policy are described in the following paragraphs.

3.3.1.1 Subjects

Subjects include two groups of native speakers (NSs) of Chinese. Group One consists of ten (N = 10) natives from Taiwan (ROC), including two males and eight females. Among them, four were enrolled as graduate students and two were graduates of various disciplines at the University of Massachusetts at Amherst (UM/A), and four were graduate students attending the Franklin Pierce Law Center (FPLC) at Concord, New Hampshire. Group Two is composed of six (N = 6) natives, which include four males and two females from China (PRC), all graduate students of the FPLC. Detailed information is shown in Table 1.

3.3.1.2 Instruments

No standardized instruments were used. Test materials were taken from Chinese newspapers and the Chinese edition of *Reader's Digest*. Tests were arranged into two parts. Part One was a two-section timed test. Section One was a vocabulary test in pinyin, with tone values added. Section Two was a vocabulary test in Chinese characters. Part Two was a survey of subjects' personal information. Complete survey form and tests are attached as Appendix B.

3.3.1.3 Procedures of Test Administration

Procedures of test administration for the two sections of Survey I are explained as follows.

3.3.1.3.1 Section I. Chinese Vocabulary in Pinyin

Fifteen nominal or verbal compounds of Chinese were selected from Chinese newspapers and Reader's Digest as vocabulary items to test NSs. Compounds were transcribed into *Pinyin*, and numbered from one to fifteen and listed under column A. Their English meanings and five extra non-related English words were listed under column C, numbered from one to twenty. Items under column A were to be matched to items under column C that had the same or closest meanings. Subjects were asked to write down their answers in the spaces under column B. Two examples were provided for reference. Two pairs of homophones, but with different tone values (A12 and A13; and A5 and A6), were used as distractors. The time spent for each section was measured either by the experimenter or by the testees themselves. Estimated time needed for completing this section was five minutes. Six of the sixteen subjects agreed to be interviewed after the test.

3.3.1.3.2 Section II. Chinese Vocabulary in Chinese Characters

Another set of fifteen vocabulary items, also selected from newspapers and magazines, are compounds in Chinese characters and are listed under column A. Twenty possible English equivalents in meaning are listed under Column C. Subjects were asked to write down the answers in the spaces under column B. Two examples are also provided for reference. Polysemous English words are used as distractors. Estimated time needed for completing this section was five minutes.

3.3.1.4 Data Gathering Methodology

Data was gathered from two sources: Test results and interviews. Data included: The time needed for completing the tests and the accuracy rate at which they scored in the tests, and anecdotal data from interviews. The interview, which was previously planned to be recorded with an cassette-tape recorder, later had to be put into a writing—survey, since all six interviewees refused to sign the consent form (see Appendix D) for being tape-recorded. The survey was later developed as an option for acquiring personal information, when initial efforts for tape-interview failed.

3.3.1.5 Scoring Policy

Since two examples were given in each section of the Test I, yielding 15 possible answers out of the remaining 18, all unanswered items were treated the same as wrong answers.

3.3.2 Experiment II—Survey II

Subjects, instruments, procedures of test administrations, data gathering methodology and scoring policy are described in the following paragraphs.

3.3.2.1 Subjects

Subjects include two groups of native speakers of Chinese and one group of non-native speakers. Group One consisted of ten (N = 10) natives from Taiwan (ROC), including four males and six females. Seven of them were graduate students at the University of Massachusetts at Amherst (UM/A), two were graduate students attending the Franklin Pierce Law Center (FPLC) at Concord, New Hampshire, and one was a college graduate. Six (N = 6) natives from China

(PRC) teamed as Group Two, four males and two females—all graduate students of the FPLC. Detailed information is shown in Table 2. The subjects in Group Two of Survey II were not exactly the same as those in Group Two of Survey I.

3.3.2.2 Instruments

Test materials were taken from Chinese newspapers and the Chinese edition of *Reader's Digest*. Tests contained two parts. Part One was a three-section timed test. Section One consists of 100 (20 groups of five) vocabulary items in both pinyin (for NSs from the PRC and NNSs) and zhuyin (for NSs from the ROC), with no tone values added. Section Two was a test on Chinese homographs, which appeared in pairs of two-character contexts in characters. Subjects would make judgments on whether the identical characters in the pairs have the sounds. Section Three was a word-recognition test, in which subjects were to choose the correct form to fit in the four-character contexts, mostly phrases or idioms. Part Two was a survey of subjects' personal information, the same as Part Two of Survey I. Complete tests are attached as Appendix C.

3.3.2.3 Procedures of Test Administration

Procedures of test administration for the three sections of Survey II are explained as follows.

3.3.2.3.1 Section I. "Do you know any words for them?"

One hundred Chinese syllables were selected to test NSs and NNSs' recognition of Chinese vocabulary. Syllables were transcribed into *Pinyin* and *zhuyin*, and placed in twenty groups of five (20 rows in five columns). Two examples were provided for reference.

The purpose of this experiment is to verify Hayes' (1987a, 1988) conclusion that Chinese tend to adopt phonology-based processing strategy in encoding visually presented characters. If this is true, then the phonology-based representation of pinyin should enjoy more advantage than other RSs in processing reading texts. Some English words were deployed to determine whether they would cause diffusion or confusion to readers in performing the task. Test included two pairs of homophones, but with different tone values (A12 and A13; and A5 and A6). Subjects circled the "non-word" syllables that do not exist in all of the four (or five) possible tone values of the Mandarin characters. The time spent for each section was measured either by the experimenter or by the testees themselves. No interviews were conducted, survey forms were used instead. Estimated time for completing this section was five to ten minutes.

3.3.2.3.2 Section II. "How do they sound?"

Sixteen pairs of two-character phrases, i.e., compounds, were selected from newspapers and magazines. Each pair contained an identical character. Subjects were to make judgments as to whether the identical character in each pair had the identical sounds in Mandarin, by circling **S** for *Same* and **D** for *Different*. Test item Number One was used as an example. Estimated time to finish this section was three to five minutes.

3.3.2.3.3 Section III. "How well can you tell?"

Sixteen pairs of four-character phrases and idioms were selected from newspapers and magazines. In each context, one word was missing and followed by two graphemically similar characters. Subjects would choose the correct forms from either the left (**L**) or the right (**R**) columns to fit in the contexts

provided. One example was given. Estimated time to finish this section was two to five minutes.

3.3.2.4 Data Gathering Methodology

Data was gathered from the test results and survey. Test data to be analyzed included: The time for needed for completing the tests and the accuracy rate at which they scored in the tests. The survey information was used to help interpret the results.

3.3.2.5 Scoring Policy

All unanswered items in Sections I, II, and III of the Test II were treated the same as wrong answers.

CHAPTER 4
ANALYSIS OF THE DATA

This chapter consists of three sections. Section one is an introduction to the factors to be determined. Section two and three are analyses of the data obtained from Survey I and Survey II respectively.

4.1 Introduction

As stated earlier, this study intends to explore the following two questions:

1. Will specific representational systems make any difference to native speakers in comprehending Chinese texts in terms of accuracy and speed? And
2. Will a specific representational system differentially affect native and non-native speakers in comprehending Chinese texts in terms of accuracy and speed?

And the following two conceptual hypotheses are proposed:

1. Native speakers of Chinese will demonstrate better performance than non-native speakers in comprehending texts represented in Chinese characters in terms of accuracy and speed.
2. Non-native speakers of Chinese (American students, in this study) will demonstrate better performance than native speakers in comprehending texts represented in pinyin in terms of accuracy and speed.

Survey I was designed to answer the first question and to test the speculation that RSs could affect reading tasks performed even by native readers. Survey II was designed to answer the second question and to confirm the two proposed hypotheses. Survey I was undertaken from early March in Concord,

New Hampshire to mid-March 1992 in Amherst and Belchertown, Massachusetts. Survey II was later redesigned and conducted from late April to early May, 1992.

4.2 Analysis of Data from Survey I

Table 1 shows some basic information about the subjects of the two native (ROC and PRC) groups, participating in Survey I. Tables 2 and 3 present comparisons of the test results in two sections in Survey I from these two groups. Table 4 compares the distribution of errors made by the two groups in Survey I.

In Table 1, more females (10 out of 16 total) participated in the test. And 15 out of total 16 subjects were in the age group of 30 - 40. Eight out of 10 natives from the ROC group were reportedly bilingual or bi-dialectal. All of the subjects in the PRC group had learned pinyin, while nine of the 10 in the ROC group had learned zhuyin and only one of them had learned pinyin. Two of the PRC group reported having difficulty in recognizing characters in complex text form.

Tables 2 and 3 reveal that the ROC subjects required more time and achieved a lower accuracy rate than the PRC subjects in completing Section I pinyin vocabulary test, represented in Figures 4.1 and 4.2 respectively. The PRC group spent more time but, to my surprise, achieved a slightly higher accuracy rate than the ROC group in Section II vocabulary test in characters. These findings confirmed that same text materials when converted into different representations could possibly affect readers. Pinyin was demonstrated to favor the PRC group in both text processing speed and accuracy rate in matching task in Section One. Chinese natives either from the ROC or the PRC showed no difference in processing texts represented in characters in terms of accuracy and speed. After-test interviews revealed that the PRC subjects were among the elite

and were able to read most complex characters with little or no difficulty since they had learned both CT and ST.

4.3 Analysis of Errors and Summary of Findings in Survey I

As observed from the results revealed in Tables 2 and 3, and Figures 4.1 and 4.2, the ROC subjects encountered more difficulty in taking the "pinyinized" vocabulary test in Section I: more time was consumed, yet lower performances were achieved. The pinyin test seemed to favor the PRC subjects, both in speed and performance. Likewise, one would assume that the character version of the test would favor the ROC group. But contrary to my expectations, the PRC group scored slightly higher than the ROC group, even though more time was needed. An analysis of error distribution, shown in Table 3, and after-test interviews demonstrated that the ROC subjects were having difficulty in decoding "specific" alphabetical representations of the following phonemes in pinyin: *ji-*, *x-* and *zh-*, which spelled otherwise as *ch-*, *hs-* and *ch-*. Chinese in Taiwan have not adopted a national standard for alphabetical representational system for written characters. The directory of the Chinese Students Club at the University of Massachusetts at Amherst provides sufficient confusing, sometimes conflicting, examples of Chinese surnames, as when *Hsu*, *Sheu*, and *Shu* are actually the same as *Xu*, meaning 'to promise.'

Table 1 Personal data of the subjects in Survey I

Survey One

Subject Information	Nat-ROC	Nat-PRC	
1. Sex	10	6	
Male	2	4	
Female	8	2	
2. Age			
Under 20			
20 - 29			
30 - 39	9	6	
40 or over	1		
3. Major			
Humanities	4		
Science/Engineering.	2	2	
Business/Law	4	4	
Other			
4. Nationality			
N America			
S America			
Africa			
Asia-Pacific	10	6	
Europe			
Other			
5-Y. Native	10	6	N/A
Taiwanese	7		
Hakka	1		
Cantonese			
Shanghainese		1	
Others			
5-N. Non-Ns	N/A	N/A	
Father	N/A	N/A	
Mother	N/A	N/A	
5A. When	N/A	N/A	
0 - 2 Years	N/A	N/A	
2 - 5 Years	N/A	N/A	
5 + Years	N/A	N/A	
5B. Where	N/A	N/A	
Neighborhood	N/A	N/A	
School	N/A	N/A	
Self-taught	N/A	N/A	
Others	N/A	N/A	

continued next page

Table 1 (continued)

5C. Hr/Wk	N/A	N/A	
0 - 4 hrs	N/A	N/A	
4 - 10 hrs	N/A	N/A	
10 + hrs	N/A	N/A	
5D. Reading	N/A	N/A	
Advanced	N/A	N/A	
Intermediate	N/A	N/A	
Novice	N/A	N/A	
6. PTS			
Yes	10	6	
IPA			
Pinyin	1	6	
Zhuyin	9		
Yale		1	
Others			
No	1		
7. PTS			
0 - 2 Years			
2 - 5 Years			
5 + Years	10	6	
8. Enjoy reading Chinese			
Yes	10	6	
8A. Preference			
Characters	10	5	
Pinyin	0	1	
No			
9. Difficulties			
Recognize char		2	
Write char			
Get char-meaning	2	1	
Pronounce char	1		
Discriminate Homoph.			
Other			
10. Strategy			
Understand pinyin/zhuyin	3	6	
Understand half	4		
Random guess	2		

Table 2 Comparisons of the test results in Section I of Survey I from two native groups

Survey One
Tests Section I Vocabulary: Pinyin

	Nat-ROC Time	Nat-ROC Correct	Nat-PRC Time	Nat-PRC Correct		
Subject No.	in sec.	in %	in sec.	in %		
S1	310	86.67	300	93.33		
S2	280	100.00	380	100.00		
S3	480	100.00	680	93.33		
S4	360	86.67	302	86.67		
S5	330	73.33	360	100.00		
S6	200	86.67	290	100.00		
S7	600	100.00				
S8	750	86.67				
S9	415	80.00				
S10	300	20.00				
Total	4025	820	2312	573.33		
Average	402.50	82.00	385.33	95.56		

Table 3 Comparisons of the test results in Section II of Survey I from two native groups

Survey One
Tests Section II Vocabulary: Character

	Nat-ROC Time	Nat-ROC Correct	Nat-PRC Time	Nat-PRC Correct		
Subject No.	in sec.	in %	in sec.	in %		
S1	108	100.00	240	100.00		
S2	145	86.67	100	100.00		
S3	300	100.00	330	100.00		
S4	300	100.00	340	100.00		
S5	60	100.00	180	100.00		
S6	85	100.00	330	93.33		
S7	180	100.00				
S8	90	100.00				
S9	180	93.33				
S10	300	86.67				
Total	1748	966.67	1520	593.33		
Average	174.80	96.67	253.33	98.89		

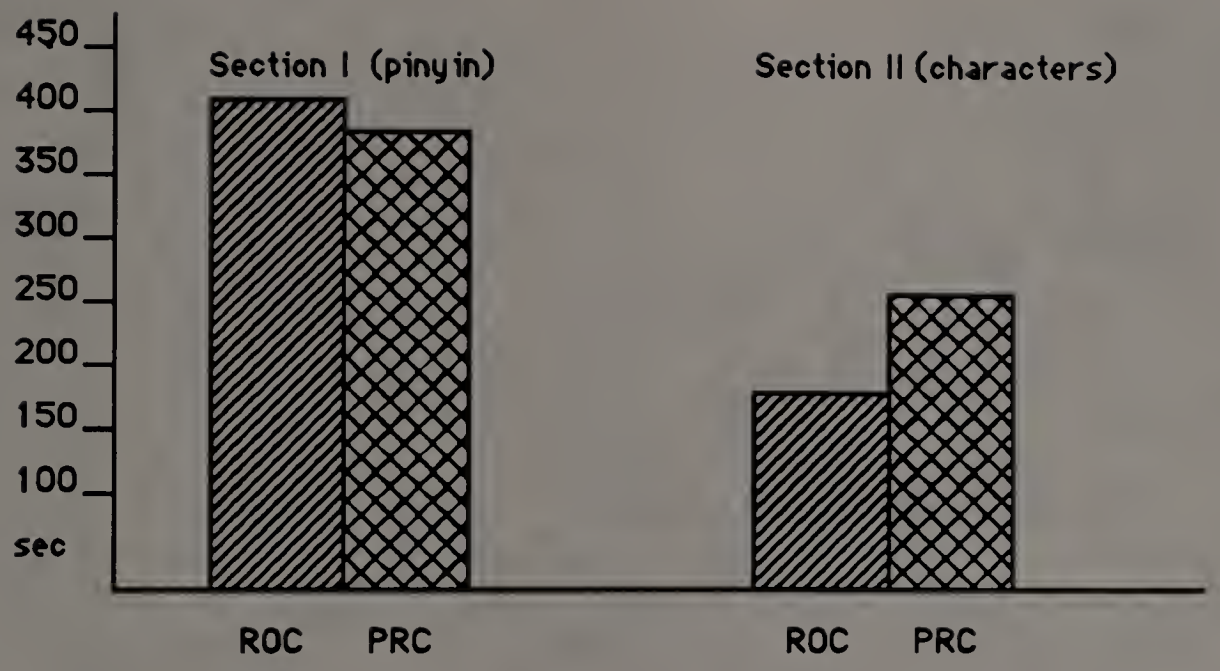

Figure 4.1 Comparisons of the time used by two native groups in Survey I

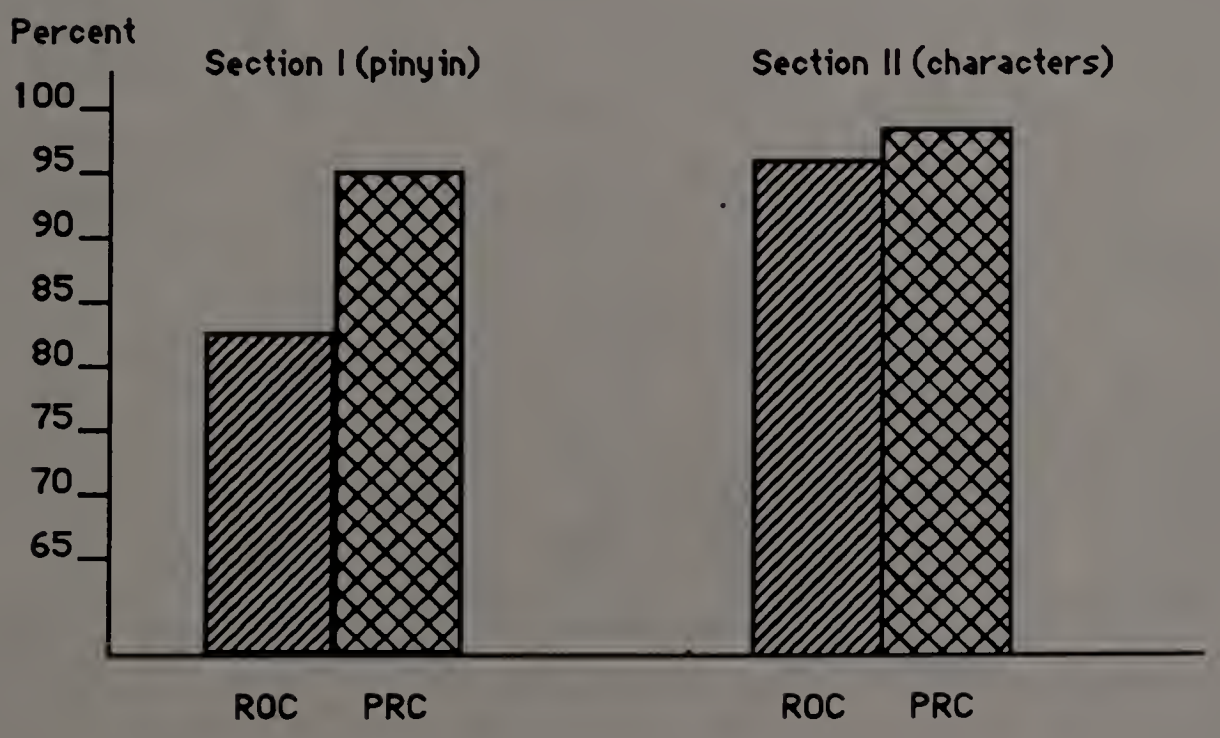

Figure 4.2 Comparisons of test performance of two native groups in Survey I

Table 4 Comparisons of the errors made by two native groups in Survey I

Survey One
Tests

Section I Error count

Item No.	N-ROC	N-PRC	
1			
2			
3	2		
4	1		
5			
6			
7			
8	1	1	
9	1	1	
10	2	1	
11	5		
12			
13		1	
14			
15	5		
Total	17	4	

Section II Error count

Item No.	N-ROC	N-PRC	
1			
2			
3	1		
4			
5			
6			
7			
8			
9		1	
10			
11			
12	1		
13			
14			
15			
Total	2	1	

4.4 Analysis of Data from Survey II

Table 5 shows basic information about the subjects of two native (ROC and PRC) groups and one non-native group (USA) participating in Survey II. Tables 6 through 11 present comparative test results in three sections of Survey II from the three groups. Figures 4.3 and 4.4 are graphic representations of the results in bar charts. Tables 12 to 13 display the distribution of errors made by the three groups in Section I of Survey II, in the order of ROC, PRC, and USA. Tables 15 and 16 contrast error distribution of the three groups in Sections II and III, respectively.

In Table 5, the ratios of male versus female participants of the test were 2:3 in the ROC (N = 10) group, 2:1 in the PRC (N = 6) group, and 1:1 in the USA (N = 6) group. The total numbers of male and female participants were the same (that is, 11). Subjects in the USA groups were comparatively much younger that those in the ROC and the PRC groups. Eight out of 10 natives from the ROC group were bilingual or bi-dialectal, with one trilingual, whereas one of the six subjects in the PRC group was bidialectal. All of the subjects in the PRC group had learned pinyin. All the 10 subjects in the ROC group had learned zhuyin. Two of them had learned more than two PTSs (pinyin or IPA symbols). All non-native subjects had learned at least one additional PTSs other than pinyin. One in the PRC group and none in either the ROC or the USA groups reported a preference in reading pinyin texts. One of the USA subjects rated himself as an advanced reader in Chinese and was the only one with a Ph.D. degree. He claimed having no difficulty in reading Chinese after having studied Chinese for more than five years and having daily encounters with Chinese-speaking students. He was ranked as the best among all participants in Section one with the score of 99 out of 100 correct (see S1 of Non-Nat in Table

9), and was the leader in the non-native group. All other non-natives encountered difficulty in recognizing, writing, or pronouncing characters. Two of the PRC group reported having difficulty in recognizing complex characters.

The ROC subjects required more time than two other groups in completing the zhuyin-version of Section I, as seen in Tables 6 and 9, more than twice as much time as the USA group needed. The USA subjects took the least amount of time and achieved the highest performance in completing pinyin section, as seen in Table 8. Table 7 demonstrated that the PRC subjects, who use both pinyin and ST systems in China, had, contrary to my expectations, the lowest accuracy rate as compared to two other groups and ranked the second of the three in required time for finishing Section I.

As observed from Tables 6 through 8, the ROC subjects demonstrated both least completion time and the highest performance in Sections two and three, presumably taking advantage of the representations in CT in the tests. In contrast, the USA group required the most time yet demonstrated the lowest performance in Sections two and three, due to their very limited experiences with Chinese characters (four of the six non-natives had studied Chinese less than five years). Comparisons of time and test performances in the three sections of Survey II by the three groups are shown in Tables 9 through 11 respectively, and are also represented in Figures 4.3 and 4.4.

4.5 Analysis of Errors and Summary of Findings in Survey II

The error distribution patterns from three sections of Survey II by the three groups are displayed in Tables 12 though 16. Table 12 reveals that the most error-prone items in Section I to native ROC group are: 2D (*cin*, 7 counts), 10E (*qong*, 7 counts), 16C (*xian*, 5 counts), 17A (*xao*, 5 counts), 17B (*xan*, 5 counts), and 17C (*xang*, 5 counts). The 16th and 17th rows in Section I account for

almost one-third (33 out of total 117, see Table 12) of all errors made by the ROC subjects. Casual talks after the test with two subjects disclosed that they tended to be "misled" by the identical shape of zhuyin symbol "T," transcribed as *x-* in pinyin, with the English letter T. Hence, they made the mistakes all the way through. That means that the English alphabet could distract their attention. The zhuyin version of the test items in Section I was basically an equivalent transcription of pinyin version, with the exception of minor differences in Item number 12D (which equals *sen* instead of *sin* in pinyin) and 18B (an equivalent of *yin* instead of *yen*).

In contrast, and to my surprise, the PRC subjects made more errors than their native ROC counterparts. In some cases, like 6C (*jao*), 10B (*qan*), 14D (*tin*), 17B (*xan*), 17C (*xang*), and 18B (*yen*), no PRC subjects scored. Casual talks after the test with some of the subjects failed to yield any satisfactory explanation. Could it be due to test-designer's errors, or the pinyin transcription system itself? *Yen* (18B) is not actually a standard "pinyinized" transcription, its close phonetic counterpart *yan* is the correct one. If an *-i-* is added to *jao*, *qan*, *xan*, *xang*, then all of them become pinyinized syllables: *jiao*, meaning 'to teach; to submit; to shout,' *qian*, meaning 'thousand; money; front; shallow; to owe,' *xian*, 'previous; salty; risky; to offer,' and *xiang*, 'fragrant; to give in; to wish, to resemble.' Section II contained rarely used items *U-FU*, an exclamation in speech, in 11, that appeared in the *Analects of Confucius*, one of the *Four Books*. Over half of the native and non-native subjects did not score on this item. Results in Section III revealed that over four out of six did not know the basic skills in calligraphic practices, addressed in Item 15. The mistakes they made on Items 8 and 10 are meaningful only if the texts are shortened to preserve the last two character to form phrases *ziji* ('self') or *daifu* (physician, medical doctor), which happened to be inappropriate to fit in the four-character or idiomatic

contexts. The PRC subjects pointed out that the phrase *zhangfu* was a phrase not commonly heard or used in China—a factor I had not taken into consideration.

The USA group, as hypothesized, spent the least amount of time (about less than half the time the two native groups needed) and yet had the highest performance in Section I (see Figures 4.3 and 4.4). The most error-prone items in Section I are: *eng* (5), *juan* (4), and *zen* (4) out of 6 counts. Their performances in two other sections of Chinese homograph-homophone and word recognition tests showed a consistent pattern: It took them the greatest amount of time and yielded the lowest scores. This is probably due to their limited knowledge and developing skill of reading Chinese characters, which put them in disadvantageous situation.

Table 5 Personal data of the three groups in Survey II

Survey Two

Subject Information	Nat-ROC	Nat-PRC	Non-Nat
1. Sex	10	6	6
Male	4	4	3
Female	6	2	3
2. Age			
Under 20			
20 - 29	4		5
30 - 39	5	6	
40 or over	1		1
3. Major			
Humanities	1		5
Science/Engineering.	5	2	1
Business/Law	4	4	
Other			
4. Nationality			
N America			5
S America			
Africa			
Asia-Pacific	10	6	1
Europe			
Other			
5-Y. Native	10	6	N/A
Taiwanese	7		
Hakka	1		
Cantonese			
Shanghainese	1	1	
Others			
5-N. Non-Ns	N/A	N/A	
Father	N/A	N/A	
Mother	N/A	N/A	
5A. When	N/A	N/A	
0 - 2 Years	N/A	N/A	1
2 - 5 Years	N/A	N/A	2
5 + Years	N/A	N/A	3
5B. Where	N/A	N/A	
Neighborhood	N/A	N/A	2
School	N/A	N/A	4
Self-taught	N/A	N/A	
Others	N/A	N/A	

continued next page

Table 5 (continued)

5C. Hr/Wk	N/A	N/A	
0 - 4 hrs	N/A	N/A	
4 - 10 hrs	N/A	N/A	5
10 + hrs	N/A	N/A	1
5D. Reading	N/A	N/A	
Advanced	N/A	N/A	1
Intermediate	N/A	N/A	5
Novice	N/A	N/A	
6. PTS			
Yes	10	6	6
IPA	1		2
Pinyin	1	6	6
Zhuyin	10		1
Yale		1	3
Others			2
No	0		
7. PTS			
0 - 2 Years			1
2 - 5 Years			3
5 + Years	10	6	2
8. Enjoy reading Chinese			
Yes	10	6	1
8A. Preference			
Characters	10	5	5
Pinyin	0	1	0
No			1
9. Difficulties			
Recognize char	2	2	3
Write char			2
Get char-meaning	2	1	2
Pronounce char	1		3
Discriminate Homoph.	1		
Other			
10. Strategy			
Understand pinyin/zhuyin	9	6	1
Understand half	1		4
Random guess			1

Table 6 Time and test performance demonstrated by the ROC group in Survey II

Survey Two	Section I		Section II		Section III	
NAT-ROC	Time	Correct	Time	Correct	Time	Correct
Subject No.	in sec.	in %	in sec.	in %	in sec.	in %
S1	600	95.00	120	93.33	120	93.33
S2	585	88.00	45	100.00	45	100.00
S3	600	95.00	120	100.00	120	100.00
S4	720	71.00	60	93.33	90	93.33
S5	625	92.00	90	100.00	45	100.00
S6	600	82.00	300	86.67	120	93.33
S7	165	94.00	40	86.67	45	100.00
S8	300	90.00	40	53.33	40	93.33
S9	320	85.00	40	93.33	40	100.00
S10	500	95.00	60	86.67	45	100.00
Total	5015	887.00	915	893.33	710	973.33
Average	501.50	88.70	91.50	89.33	71.00	97.33

Table 7 Time and test performance demonstrated by the PRC group in Survey II

Survey Two	Section I		Section II		Section III	
NAT-PRC	Time	Correct	Time	Correct	Time	Correct
Subject No.	in sec.	in %	in sec.	in %	in sec.	in %
S1	159	86.00	180	66.67	60	80.00
S2	238	87.00	177	73.33	158	80.00
S3	600	70.00	120	73.33	80	86.67
S4	540	72.00	120	66.67	60	86.67
S5	420	82.00	60	66.67	60	86.67
S6	300	77.00	60	66.67	60	86.67
Total	2257	474.00	717	413.33	478	506.67
Average	376.17	79.00	119.50	68.89	79.67	84.44

Table 8 Time and test performance demonstrated by the non-native (USA) group in Survey II

Survey Two	Section I		Section II		Section III	
Non-NAT (USA)	Time	Correct	Time	Correct	Time	Correct
Subject No.	in sec.	in %	in sec.	in %	in sec.	in %
S1	195	99.00	105	66.67	110	73.33
S2	402	83.00	50	40.00	unspecif.	33.33
S3	240	93.00	300	53.33	225	66.67
S4	270	91.00	120	66.67	200	80.00
S5	120	92.00	60	46.67	180	53.33
S6	120	78.00	420	33.33	300	40.00
Total	1347	536.00	1055	306.67	1015	346.67
Average	224.50	89.33	175.83	51.11	203.00	57.78

Table 9 Comparisons of time and test performance of the three groups in Section I

Survey Two

Tests	Section I (Vocabulary: Zhuyin vs. pinyin)					
	Nat-ROC	Nat-ROC	Nat-PRC	Nat-PRC	Non-Nat	Non-Nat
Subject No.	Time	Correct	Time	Correct	Time	Correct
	in sec.	in %	in sec.	in %	in sec.	in %
S1	600	95	159	86	195	99
S2	585	88	238	87	402	83
S3	600	95	600	70	240	93
S4	720	71	540	72	270	91
S5	625	92	420	82	120	92
S6	600	82	300	77	120	78
S7	165	94				
S8	300	90				
S9	320	85				
S10	500	95				
Total	5015	887	2257	474	1347	536
Average	501.50	88.70	376.17	79.00	224.50	89.33

Table 10 Comparisons of time and performance of the three groups in Section II

Survey Two Tests	Section II					
	Nat-ROC	Nat-ROC	Nat-PRC	Nat-PRC	Non-Nat	Non-Nat
Subject No.	Time	Correct	Time	Correct	Time	Correct
	in sec.	in %	in sec.	in %	in sec.	in %
S1	120	93.33	180	66.67	105	66.67
S2	45	100.00	177	73.33	50	40.00
S3	120	100.00	120	73.33	300	53.33
S4	60	93.33	120	66.67	120	66.67
S5	90	100.00	60	66.67	60	46.67
S6	300	86.67	60	66.67	420	33.33
S7	40	86.67				
S8	40	53.33				
S9	40	93.33				
S10	60	86.67				
Total	915	893.33	717	413.33	1055	306.67
Average	91.50	89.33	119.50	68.89	175.83	51.11

Table 11 Comparisons of time and test performance of the three groups in Section III

Survey Two Tests	Section III					
	Nat-ROC	Nat-ROC	Nat-PRC	Nat-PRC	Non-Nat	Non-Nat
Subject No.	Time	Correct	Time	Correct	Time	Correct
	in sec.	in %	in sec.	in %	in sec.	in %
S1	120	93.33	60	80.00	110	73.33
S2	45	100.00	158	80.00	unspecif.	33.33
S3	120	100.00	80	86.67	225	66.67
S4	90	93.33	60	86.67	200	80.00
S5	45	100.00	60	86.67	180	53.33
S6	120	93.33	60	86.67	300	40.00
S7	45	100.00				
S8	40	93.33				
S9	40	100.00				
S10	45	100.00				
Total	710	973.33	478	506.67	1015	346.67
Average	71.00	97.33	79.67	84.44	203.00	57.78

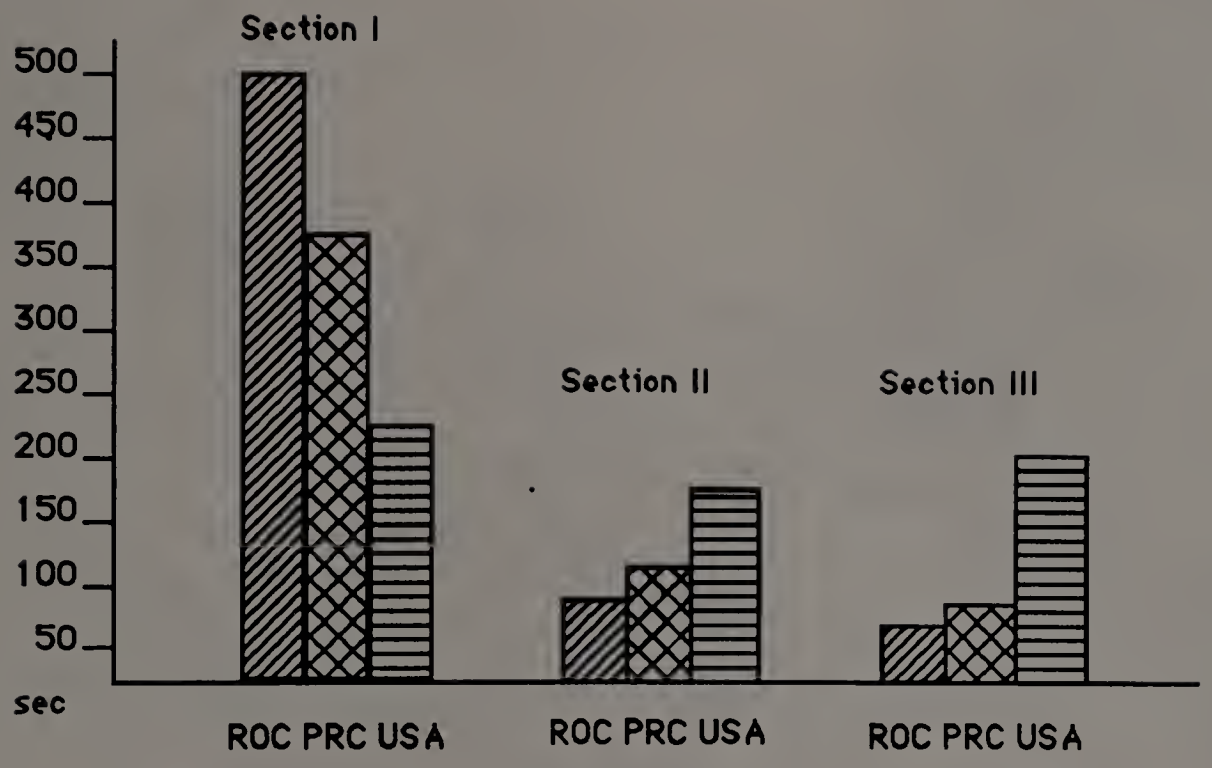

Figure 4.3 Comparisons of the time used by three groups in three sections of Survey II

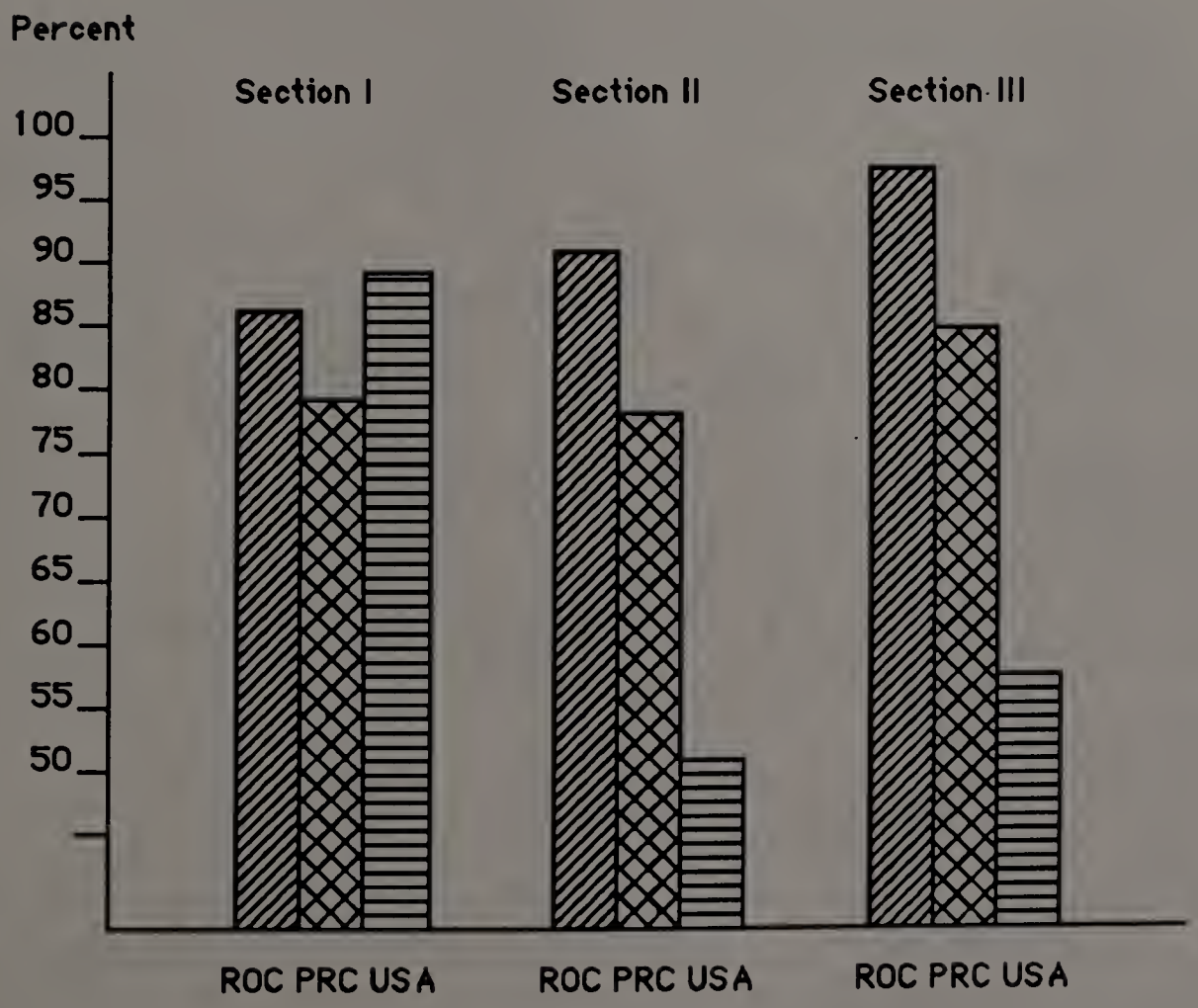

Figure 4.4 Comparisons of test performance of the three groups in three sections of Survey II

Table 12 Error distribution in Section I of Survey II by the ROC group

Survey Two
Section One **Native Speakers: ROC** **N = 10**

Item No.	A	B	C	D	E	Subtotal
1		2			1	3
2			1	7	2	10
3	1				2	3
4	1			4		5
5				1		1
6	2	1	1	2	2	8
7	1	1	3	1	1	7
8	1	2	1	2		6
9			1		2	3
10	1	1	1		7	10
11			1	2	4	7
12		3		1	0	4
13						0
14		1	2	1		4
15			1	1	1	3
16		5	1	3	2	11
17	5	5	5	3	4	22
18	1	1	1			3
19	1	2	1		1	5
20			2			2
Total	14	31	22	36	29	117

Table 13 Error distribution in Section I of Survey II by the PRC group

Survey Two
Section One **Native Speakers: PRC** **N = 6**

Item No.	A	B	C	D	E	Subtotal
1	0	2	0	1	3	6
2	0	0	0	2	0	2
3	1	0	0	2	0	3
4	0	0	0	4	0	4
5	0	0	2	2	1	5
6	5	5	6	0	2	18
7	0	1	0	1	1	3
8	1	0	2	2	0	5
9	0	0	0	0	0	0
10	5	6	1	0	0	12
11	0	3	1	6	0	10
12	0	2	0	3	1	6
13	0	1	0	0	1	2
14	0	0	4	6	2	12
15	0	1	1	0	1	3
16	0	1	0	1	0	2
17	5	6	6	0	1	18
18	0	6	0	0	2	8
19	0	0	2	0	0	2
20	0	1	3	0	1	5
Total	17	35	28	30	16	126

Table 14 Error distribution in Section I of Survey II by the USA group

Survey Two
Section One **Non-Native Speakers** **N = 6**

Item No.	A	B	C	D	E	Subtotal
1		1	2	3	5	11
2						0
3				2	2	4
4					1	1
5						0
6	1	1	1		3	6
7				4	3	7
8	1			1		2
9	1			3		4
10		1	1		1	3
11		2		3		5
12	1	1			2	4
13	1					1
14					2	2
15						0
16	1					1
17	1		1			2
18						0
19	1	4			3	8
20			3			3
Total	8	10	8	16	23	64

Table 15 Error distribution in Section II of Survey II by the three groups

Survey II
Section II

	Nat-ROC	Nat-PRC	Non-NAT	
Item No	Error count	Error count	Error count	Subtotal
1				0
2		1	1	2
3		1	3	4
4	1	4	5	10
5	1		3	4
6		3	2	5
7	2	2	2	6
8	2		2	4
9		5	3	8
10			1	1
11	4	5	3	12
12	2		2	4
13	1	2	1	4
14	2	5	3	10
15			1	1
16	1		2	3
Total	16	28	34	78

Table 16 Error distribution in Section III of Survey II by the three groups

Survey II
Section III

	Nat-ROC	Nat-PRC	Non-NAT	
Item No	Error count	Error count	Error count	Subtotal
1				0
2			3	3
3			1	1
4			5	5
5			3	3
6			3	3
7			2	2
8	4	5	5	14
9			2	2
10		5	2	7
11			3	3
12				0
13				0
14			5	5
15		4	1	5
16			3	3
Total	4	14	38	56

4.6 Conclusions

The two Surveys for this study answered the two questions raised earlier that a specific RS did make a difference to native as well as non-native readers of Chinese. Test results as presented above also confirm the two hypotheses stated earlier that native readers of Chinese demonstrated better performance both in terms of processing speed and accuracy than non-native readers when texts were presented in characters, no matter what kind of text, simplified or complicated. In contrast, non-native readers performed better than native readers in pinyin vocabulary test, both in processing speed and accuracy. Their limited knowledge of Chinese characters might have placed non-natives in unfavorable situation, when L1 readers of Chinese had already recognized about 3,000 commonly used characters. (Zhang and Simon, 1985, p. 193 pointed out 7,000 characters, but Liu, 1992, cited this number based on a Japanese research report that investigated the frequency of characters appeared in more than 90 Chinese magazines and journals.)

Apparently, the pinyin system has its problems in syllabification. The aforementioned instance *xian* could be "mis-pronounced" as *xi-an*, a nominal compound meaning 'west coast.' This is probably why its homophonous counterpart, a city in Central China, is spelled as *Xi'-an*, with a "redundant" apostrophe after *Xi*. Consonant-alone syllables are automatically added with an "-i," such as *zi* ('word, character'), *ri* ('the sun; a day'), *shi* ('lion; to test; to try'), *si* ('four; silk'), *yi* ('one; to choke'), and numerous others. But problems emerge when some syllables, e.g., -an, -en, -eng, -in, -ing, -un, are affixed to their endings. Figure 4.5 lists a partial chart of Mandarin syllable combinations. Irregularities in sound patterns are highlighted in **bold** print. The syllable ending *-un* in *zun*, *sun*, *shun*, for instance, is pronounced differently with the

identical ending *-un* in *yun*, *xun*, *jun*, with the *-u* sounded same as the German umlaut *ü* (or its alternative representation as *ue*). The *-i* in *ji-* and *qi-* becomes invisible when combined with *-ian*. One will wonder whether the *-i* in *jian* and *qian* belongs to the initial (i.e., *i-*) or the ending part (i.e., *-i*) of syllables. Similarly, the ending *-ou* appears to be different in the contexts that "*y(i)- + -ou* become *you*," but "*x(i)- + -ou* become *xiu*," as in *youxiu*, meaning 'excellent.'

	-an	**-ian**	**-e(r)**	**-en**	**-eng**	**-in**	**-ing**	**-u**	**-un**
zi-	zan	N/A	ze	zen	zeng	N/A	N/A	zu	zun
ci-	N/A	N/A	ce	cen	N/A	N/A	N/A	cu	cun
si-	san	N/A	N/A	sen	N/A	N/A	N/A	su	sun
ri-	ran	N/A	re	ren	reng	N/A	N/A	ru	run
ji-	**N/A**	**jian**	N/A	N/A	N/A	**jin**	jing	**ju**	**jun**
qi-	**N/A**	**qian**	N/A	N/A	N/A	**qin**	**qing**	**qu**	**qun**
xi-	N/A	N/A	N/A	N/A	N/A	xin	xing	**xu**	**xun**
yi-	yan	**yan**	N/A	N/A	N/A	yin	ying	**yu**	**yun**

Figure 4.5 A partial chart of Mandarin syllables represented in pinyin

Language tests administered to L1 and L2 speakers could itself reveal, in most cases I believe, an "unfair competition," to borrow the concept I learned from my law-school subjects (See also Alderson and Urquhart, 1988 for the discussion of a similar issue). Taking into account of both the small amount of vocabulary items selected for testing and the limited number of native and non-native subjects, covariance between the RSs and the groups is not assumed. Further large-scale and longitudinal research will still be necessary to provide a more comprehensive understanding.

CHAPTER 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter consists of three sections. Section one is a summary of the purpose and findings of the study. The second section contains the conclusions drawn from the study. Section three discusses the recommended further research based on the study.

5.1 Summary

Learning Mandarin Chinese typically involves a mediational system known as *phonetic transcription system* (PTS)—syllabic or phonetic systems to represent the sounds of written Chinese. Two predominantly used PTSs in learning Chinese are: *Zhuyin fuhao* and *Pinyin* (Laychuk, 1983; Walton, 1989). Zhuyin uses symbols taken from parts of the Chinese script, while Pinyin is a *romanization system*, a syllabic system that employs the Roman alphabet to represent the sounds of Chinese logographs.

Choosing a mediational system to teach the sounds of Chinese logographs has always been a controversial issue among Chinese language instructors in the United States (Walton, 1989). Zhuyin fuhao can represent all possible syllables, but students have to learn a new set of 37 symbols. Pinyin system is easier for learners of alphabetic languages, but can cause confusion in syllabification. Logographs represent "authentic" Chinese writing, yet provide little clue to the pronunciation.

Since Chinese has three types of representation, namely, in logographic, syllabary, and alphabetic, and one type of RS is normally learned earlier than others with the final goal of achieving proficiency in reading logographs, it is

worth knowing how and to what extent a representation system will affect the processing of Chinese texts by both native and non-native speakers. Will an alphabetic RS such as pinyin enjoy the advantage in performing reading task over other RSs and by NSs more than NNSs?

Researchers found native speakers (NSs) and non-native speakers (NNSs) of Mandarin Chinese used different strategies in recalling visually-presented Chinese texts (Chu-Chang and Loritz, 1977; Biederman and Tsao, 1979; Zhang and Simon, 1985; Hayes, 1987a, 1987b, and 1988; Perfetti and Zhang, 1991). Chu-Chang and Loritz (1977) found that Chinese subjects encoded Chinese ideographs phonologically while Chinese and Spanish (ESL) learners encoded English words (i.e., alphabetic texts) visually in their word-recognition and recall tests on Chinese and English demonstrated by Cantonese-Chinese and English-Spanish bilinguals.

Hayes discovered that (1) NSs made significantly more phonological errors than NNSs did at the word level; and (2) NNSs made significantly more graphic errors than NSs did at the sentence level. He concluded that (1) The NSs, at the sentence level of processing, used a mix of graphic and semantic processing strategies; and (2) NNSs seemed to rely heavily on the graphic processing strategy while reading sentences.

This research extends Chu-Chang and Loritz (1977) and Hayes' (1987a) studies and explores the effects of RSs on text processing by native and non-native readers of Chinese by answering the following two questions:

1. Will specific representational systems make any difference to native speakers in comprehending Chinese texts in terms of accuracy and speed? And

2. Will a specific representational system differentially affect native and non-native speakers in comprehending Chinese texts in terms of accuracy and speed?

And two conceptual hypotheses are proposed:

1. Native speakers of Chinese will demonstrate better performance than non-native speakers in comprehending texts represented in Chinese characters in terms of accuracy and speed.
2. Non-native speakers of Chinese (American students, in this study) will demonstrate better performance than native speakers in comprehending texts represented in pinyin in terms of accuracy and speed.

To explore these questions, two surveys were conducted. Survey I tested native Chinese in two different graphemic representations, namely, pinyin text and characters. Survey II tested both natives and non-natives in two representations—the choice of one between pinyin and zhuyin, and characters. Two native, the ROC and the PRC, groups participated in Surveys I and II, and one non-native, the USA, group participated in Survey II. After-test interviews were also undertaken for Survey I to better understand testees' language background and their responses to the test.

In Survey I, the ROC subjects, who had never learned pinyin, required slightly more time and achieved lower accuracy rate than the PRC subjects in pinyinized vocabulary test (refer Figures 4.1 and 4.2). Chinese natives, from both the ROC and the PRC, showed no difference in processing texts represented in characters. The findings affirmed that same text materials when converted into different representations could affect native readers. Alphabetized pinyin system favored the PRC group in both text processing speed and accuracy rate (refer Tables 2-4).

In Survey II, the ROC subjects required more time than two other groups in zhuyin section I, more than twice as much time as the USA group needed, who took the pinyin section (refer to Table 9). The USA subjects took the least amount of time and achieved the highest performances in the pinyin section. The PRC subjects, who use both pinyin and ST systems in China, had the lowest accuracy rate as compared to two other groups and ranked the second of the three in required amount of time (refer Figures 4.3 and 4.4).

The ROC subjects used the least amount of time and showed the highest performance in the character sections, presumably taking advantage of the representations in CT in the tests (see Tables 10 and 11). As contrasted, the USA group required the greatest amount of time and demonstrated the lowest performance in character sections, due presumably to their very limited competence with Chinese characters. Findings seem to demonstrate a consistent pattern with Hayes' discovery that natives made more phonological errors than non-natives at the word level and support the two hypotheses of this study that RSs will affect both native and non-native readers of Chinese in text processing.

5.2 Conclusions

The two Surveys for this study answered the two questions raised earlier that a specific RS did make difference to native as well as non-native readers of Chinese. Test results as presented above also confirmed the two hypotheses stated earlier that native readers of Chinese would demonstrate better performance both in terms of processing speed and accuracy than non-native readers when texts were presented in characters, no matter what kind of text, simplified or complicated. The findings lead to the following conclusions:

1. The beginning and intermediate non-native learners of Mandarin Chinese, who in the study were Americans and started with pinyin, benefit from

processing alphabetized representation of the Chinese language in terms of processing speed and accuracy rate—requiring less time and achieving a higher performance.

2. Native Chinese who have learned zhuyin or pinyin before acquiring competent skill in reading character-based texts demonstrated lower performances than did non-native speakers in processing texts represented in either zhuyin or pinyin in terms of speed and accuracy.

The findings seem to reject Hayes' (1987a) assumption that the predominant type of errors made reflect the predominant use of that type of strategy in encoding visual-based Chinese texts. The findings support with Biederman's and Tsao (1987) and Rusted's (1988) findings that logographic representation might provide more rapid and precise access for text processing at the advanced level than syllabic and alphabetical representations. One particular pattern is apparent: A representational system which is more efficient at the beginning level will become less efficient at the advanced level and *vice versa*. This implies that instructors should teach both RSs, logographic and syllabic or alphabetic systems, to beginning readers, and switch to logographic representation once the learning of the two systems become balanced.

5.3 Recommendations

The limitations embedded in this study can be further improved or overcome in several ways. First, the calculation of the time for the tests by testees themselves could yield significant imprecision, when modern timepieces also use various RS to designate time, digitally or graphically. Testees could have rounded down the time they actually used to the minutes, if their watches could not show time up to the seconds.

Next, due to the limited availability of non-native learners of Mandarin Chinese in this study, NNSs were unable to be placed in various groups, such as beginners, intermediate and advanced learners, for a comparative study. Previous thoughts of using beginning NSs of Chinese (i.e., first and second graders in Taiwan) for a contrastive study with the beginning CSL/CFL learners (e.g., Americans) were later rejected due to the considering factor of apparent "unfair competition" in several manners, when native beginners have been exposed to Chinese-speaking environments since birth but L2 learners have not.

A longitudinal study will also contribute significantly to the study of the efficiency and proficiency of transitional or mediated learning from syllabic or alphabetic to logographic representations. Furthermore, since simplified text and complex text still share a vast number of common characters, it will be interesting to know whether the findings will be the same when the CT used in this study is converted to ST.

If learning the basics involves the acquisition of numerous RSs or mini-systems of meaning, it will also be worthwhile knowing whether a substitute or supplemental RS can be used as a remedy, when the RS currently in use fails.

APPENDICES

APPENDIX A
PHONETIC TRANSCRIPTION SYSTEMS FOR CHINESE

Comparison charts of Mandarin Chinese consonants and vowels and the representation of tones in five commonly used phonetic transcription systems are listed in Tables A-1 through A-3 respectively. The five systems include Mandarin Phonetic Symbols (MPS or Zhuyin), Pinyin, Kwoyeu Romatzyh (KR), Thomas Wade system (Wade), and Yale system (Yale). [Adapted in part from Liang, *et al.* (eds., 1972), pp. 1354-1356.]

Part One: Consonants

Table A-1 A comparison chart of Mandarin Chinese consonants in five commonly used phonetic transcription systems.

PTS:	MPS	Pinyin	K R	Wade	Yale
	ㄅ	b	b	p	b
	ㄆ	p	p	p'	p
	ㄇ	m	m	m	m
	ㄈ	f	f	f	f
	(ㄪ)		(v)		
	ㄉ	d	d	t	d
	ㄊ	t	t	t'	t
	ㄋ	n	n	n	n
	ㄌ	l	l	l	l
	ㄍ	g	g	g	g
	ㄎ	k	k	k	k
	(ㄫ)		(ng)		
	ㄏ	h	h	h	h
	ㄐ	j	j(i)	ch(i)	j(i)
	ㄑ	q	ch(i)	ch'(i)	ch(i)
	(ㄬ)		(gn)		
	ㄒ	x	sh(i)	hs	s(i)
	ㄓ	zh	j	ch	j
	ㄔ	ch	ch	ch'	ch
	ㄕ	sh	sh	sh	sh
	ㄖ	r	r	j	r
	ㄗ	z	tz	tz, ts-	dz
	ㄘ	c	ts	tz', ts'-	ts
	ㄙ	s	s	sz, ss, s-	s

Part Two: Vowels

Table A-2 A comparison chart of Mandarin Chinese vowels in five commonly used phonetic transcription systems.

PTS:	MPS	Pinyin	K R	Wade	Yale
	(ㄭ)		y	-u, -ih	z, r
	ㄚ	a	a	a	a
	ㄛ	o	o	o	o(wo)
	ㄜ	e(r)	e	o(è)	é
	ㄝ	e	è		e
	ㄞ	ai	ai	ai	ai
	ㄟ	ei	ei	ei	ei
	ㄠ	ao	au	ao	au
	ㄡ	ou	ou	ou	ou
	ㄢ	an	an	an	an
	ㄣ	en	en	en	en
	ㄤ	ang	ang	ang	ang
	ㄥ	eng	eng	eng	eng
	ㄦ	er	el	erh	er
	ㄧ	yi, -i	i	i	yi, -i
	ㄨ	w(u)-, -u	u	wu	wu, -u
	ㄩ	yu, -u(e)	iu	yü, -ü	yu

Part Three: Tones

Table A-3 The representation of Mandarin Chinese tones in five commonly used phonetic transcription systems.

PTS:	MPS	Pinyin	K R	Wade	Yale
	—	—	(—)*	1	—
	ˊ	ˊ	ˊ	2	ˊ
	ˇ	ˇ	ˇ	3	ˇ
	ˋ	ˋ	ˋ	4	ˋ
	•			5	

* Used as an option.

APPENDIX B

SURVEY OF PINYIN—I

Purpose:

This survey attempts to get information concerning about how Pinyin system will affect the learning and comprehending of Chinese texts by native and non-native speakers of Chinese.

Contents Inside:

Survey includes two parts. Part One is a two-section test on Chinese vocabulary. Part Time is a survey of your personal information and your language background.

Directions:

Since you will remain anonymous in this test as well as in a future research report, so your performance will not affect your final grade in any courses. All your information will be treated as confidential and is for research purposes only.

Part One is a timed test on vocabulary. So please record the time you start and finish each section. Estimated time for Section One is five to ten minutes for each section.

Part Two, a survey of some basic background information about your language learning, will take about three to six minutes to complete.

If you wish to be interviewed after the test, please check (√) in the spaces below. Your time, patience, participation, and cooperation will be very greatly appreciated.

_____ **Native learner of Chinese**

_____ **Non-native learner of Chinese**

Time spent for Vocabulary Test

	Start	Finished	Actual time used
Section 1:	_____:_____:_____	_____:_____:_____	_____Min. _____Sec.
Section 2:	_____:_____:_____	_____:_____:_____	_____Min. _____Sec.

Do you wished to be interviewed?

_____ Yes Phone number: _____

_____ No

PART ONE: VOCABULARY TESTS

SECTION ONE: Vocabulary (In *Pin-yin*)

Directions: In the following, you will find 15 nominal or verbal compounds (numbered 1 to 15) listed under column A, answering spaces under column B, and 20 English words under column C. Your task is to match the Chinese vocabulary under column A with their individual corresponding English meanings listed under column C. Write your answers under the spaces under column B. Two examples, a. and b. are provided for your reference. Make sure you know how to do this exercise before you begin.

A. Vocabulary		B. Answers:	C. Meanings:
Examples:			
a.	míngtian	16	
b.	kǎoshì	18	
1.	bingxiang	_____	1. accident
2.	guanguang	_____	2. classroom
3.	guǎnlǐ	_____	3. country
4.	gùshì	_____	4. drive
5.	jǐandan	_____	5. eyes
6.	jiandàn	_____	6. eye-glasses
7.	jìaoshì	_____	7. frying an egg
8.	kaiche	_____	8. ice box
9.	shènglì	_____	9. kick
10.	shìgù	_____	10. manage
11.	xiangcun	_____	11. obligation
12.	yǎnjing	_____	12. patent
13.	yǎnjìng	_____	13. risk
14.	yìwù	_____	14. simple
15.	zhuanlì	_____	15. story
			16. tomorrow
			17. tour
			18. test
			19. writing
			20. victory

SECTION TWO: Vocabulary (In Chinese characters)

Directions: In the following, you will find 15 nominal or verbal compounds (numbered 1 to 15) listed under column A, answering spaces under column B, and 20 English words under column C. Your task is to match the Chinese vocabulary under column A with their individual corresponding English meanings listed under column C. Write your answers under the spaces under column B. Two examples, a. and b. are provided for your reference. Make sure you know how to do this exercise before you begin.

A. Vocabulary	B. Answers:	C. Meanings:
Examples:		
a. 工人	19	
b. 產品	14	
1. 利用	_____	1. answer
2. 照片	_____	2. appear
3. 出現	_____	3. buy
4. 躊躇	_____	4. center
5. 結局	_____	5. decide
6. 中心	_____	6. drive
7. 喪生	_____	7. ending
8. 火車	_____	8. exercise
9. 作品	_____	9. fire engine
10. 開車	_____	10. fund
11. 問題	_____	11. hesitate
12. 基金	_____	12. lose life
13. 決定	_____	13. photo
14. 出租	_____	14. product
15. 運動	_____	15. question
		16. rent
		17. train
		18. use
		19. worker
		20. works

ANSWERS

Section One:

	Vocabulary	Answers:	
1.	bingxiang	8.	ice box
2.	guanguang	17.	tour
3.	guǎnlǐ	10.	manage
4.	gùshì	15.	story
5.	jiǎndan	14.	simple
6.	jiandàn	7.	frying an egg
7.	jìaoshì	2.	classroom
8.	kaiche	4.	drive
9.	shènglì	20.	victory
10.	shìgù	1.	accident
11.	xiangcun	3.	country
12.	yǎnjing	5.	eyes
13.	yǎnjìng	6.	eye-glasses
14.	yìwù	11.	obligation
15.	zhuanlì	12.	patent

Section Two:

	Vocabulary	Answers:	
1.	利用	18.	use
2.	照片	13.	photo
3.	出現	2.	appear
4.	躊躇	11.	hesitate
5.	結局	7.	ending
6.	中心	4.	center
7.	喪生	12.	lose life
8.	火車	17.	train
9.	作品	20.	works
10.	開車	6.	drive
11.	問題	15.	question
12.	基金	10.	fund
13.	決定	5.	decide
14.	出租	16.	rent
15.	運動	8.	exercise

PART TWO: SURVEY

第二部份　問卷調查

Directions:

In the following questions about your personal information and language background, please check (√) the appropriate answers in the blanks provided.

說 明

請在下列有關閣下個人及語言背景問題中，於適當的答案欄打上勾號（√).

1. Your sex: 性別

_____ Male 男
_____ Female 女

2. Your age group: 年齡

_____ Under 20 未滿二十歲
_____ 20 - 29 二十至二十九歲
_____ 30 - 39 三十至三十九歲
_____ 40 or over 四十歲以上

3. What is (or was) your field of study (major)? 主修學科

_____ Humanities (arts, literature, education, etc.) 人文科學
_____ Sciences, engineering 理工
_____ Business, laws 法商
_____ Other *Specify:* _____ 其他 請說明

4. What is your nationality (country)? 國籍

_____ North America 北美
_____ South America 南美
_____ Africa 非洲
_____ Asia-Pacific 亞洲-太平洋
_____ Europe 歐洲
_____ Other *Specify:* _____ 其他 請說明

5. Are you a native speaker of Mandarin Chinese?
華語是你的母語嗎

_____ **Yes** 是

If yes, what other Chinese dialects do you speak?
如是，你會說其他方言嗎

_____ Taiwanese (Fukienese, Amoy) 閩南話
_____ Hakka (Kejiahua) 客家話
_____ Cantonese (Guangdonghua) 廣東話
_____ Shanghainese 上海話
_____ Others *Specify:* _____ 其他 請說明

(If yes, skip 5A-5D and continue with 6.)

_____ **No** 不是

If no, does any of your parents speak Mandarin Chinese?
如不是，你的父母會說華語嗎

_____ Yes (Check all that applies) 會

_____ Father (or step-father) 父親會說
_____ Mother (or step-mother) 母親會說

_____ **No (Continue 5A through 5D.)** 不會

5A. When did you first start learning Mandarin Chinese?
你何時開始學中文

_____ Less than two years ago 不到兩年前
_____ Two to five years ago 兩年到五年前
_____ More than five years ago 五年多以前

5B. Where did you first start learning Chinese?
你在何地開始學中文

_____ From neighborhoods (Friends or relatives) 鄰居
_____ In schools (academic institutions) 學校
_____ Self-taught (books, newspapers, or audio-visual materials) 自學
_____ Others *Specify:* _____ 其他 請說明

5C. How many hours <u>a week</u> do you estimate you spend studying Chinese?
你每週花幾小時學中文

_____ Less than four hours 少於四小時
_____ Four to ten hours 四到十小時
_____ More than ten hours 十小時以上

5D. How do you rate your level of proficiency in reading Chinese?
你自認自己的中文閱讀能力

_____ Advanced (can read and understand most articles in Chinese newspapers) 良好。能閱中文書報

_____ Intermediate (recognize most characters in articles but have difficulties in understanding contexts) 中等

_____ Novice (recognize very limited Chinese characters)
初學。認字有限

6. Have you learned any phonetic transcription systems (PTSs) in learning Mandarin Chinese?
你學過中文的標音系統嗎

_____ **Yes 有**

If yes, which systems? 如有，那一種

_____ IPA (International Phonetic Alphabet) symbols萬國音標
_____ *Pin-yin* 漢語拼音
_____ *Zhu-yin* (or *chu-yin*) *fu-hao* 注音符號
_____ Yale 耶魯拼音
_____ Others *Specify:* _____
其他 請說明

_____ **No 沒有**
If no, how do you memorize individual sounds of Chinese characters?
如沒有，你如何記住中文的字音? 請說明

Specify: _____

7. How long have you been studying or using *pin-yin* (or *zhu-yin* or any other PTSs)?
你學或用拼音（或注音 或其他標音系統）有多久了

_____ Less than two years 少於兩年
_____ Two to five years 兩年到五年
_____ More than five years 五年以上

8. Do you enjoy reading Chinese magazines or newspapers?
你喜歡閱讀中文書報雜誌嗎

_____ Yes **喜歡**

(If yes, continue with 8A)

_____ No *Specify:* _____
不喜歡 請說明

8A. Do you feel more competent (or comfortable) reading Chinese texts printed in Chinese characters than in *pin-yin* or any other PTSs? (Which version is easier for you to remember texts in Chinese?)
你喜歡閱讀以中文版或拼音版印行的書類篇章嗎

_____ Yes (Chinese characters) 是（中文版）
_____ No (*Pin-yin* or PTSs) 不（拼音版）

9. What is your major difficulty in learning Chinese? (Check all that applies)
你學習中文的主要困難在於

_____ recognizing Chinese characters 認字
_____ writing Chinese characters (complicated strokes) 寫字
_____ understanding the meanings of Chinese characters 不明字義
_____ pronouncing individual characters correctly (four tone values) 發音困難
_____ discriminating homophones 區別同音字

Other *Specify:* _____
其他 請說明

10. What strategies did you use to get the answers in the tests? (Interview--optional)
你怎麼解答本測驗的問題

_____ I fully understand *pin-yin* 全懂，學過拼音
_____ I understand about half of the test items 懂得的超過一半
_____ I understand less than half of the test items and have to make random guesses 懂得的不到一半，用猜的

APPENDIX C

SURVEY OF PINYIN—II

Purpose:

This survey intends to get information about how Pinyin system will affect the learning and comprehending of Chinese texts by native and non-native speakers of Mandarin Chinese.

Contents Inside:

Test materials include two parts. Part One is a three-section vocabulary test and Part Two a survey of your language learning background.

Directions:

Since you will remain anonymous in this test as well as in a future research report, so your performance will not affect your final grade in any courses. All your information will be treated as confidential and is for research purposes only.

Part One is a timed vocabulary test, so we ask you to record the time you start and finish each section. Estimated time for Section One is five to ten minutes, and one to three minutes for Sections Two and Three each.

Part Two, a survey of some basic background information about your language learning, will take about three to six minutes to complete.

Thank you for your time, patience, participation, and cooperation.

_____ **Native learner of Chinese**

_____ **Non-native learner of Chinese**

Time used for Vocabulary Test

	Start	Finished	Actual time used
Section 1:	_____:_____:_____	_____:_____:_____	_____Min. _____Sec.
Section 2:	_____:_____:_____	_____:_____:_____	_____Min. _____Sec.
Section 3:	_____:_____:_____	_____:_____:_____	_____Min. _____Sec.

PART ONE: VOCABULARY TEST (*PINYIN*)

SECTION ONE: Do you know any words for them?

Directions: This section tests your knowledge of Chinese vocabulary. You will find 20 groups of Mandarin characters transcribed in *pinyin* or *zhuyin*. Each group consists of five items. Your task is to find out **all** (Note: some may have none or more than one) the items that are **not** Chinese vocabulary and **circle** them on the test sheet. Two examples, a. and b. are provided for your reference. Make sure you know how to do this exercise before you begin. The time you spend will be measured, so please record the time your start and the time you complete this section. Thank you.

Examples:

a.	**ba**	**ban**	**bi**	**bu**	**(bun)**
b.	**ma**	**man**	**men**	**(mia)**	**(mun)**

Starting Time: _____:_____:_____

1.	**an**	**ang**	**ao**	**en**	**eng**
2.	**cai**	**cao**	**ci**	**cin**	**cong**
3.	**chai**	**chao**	**chi**	**chun**	**chong**
4.	**da**	**dan**	**di**	**do**	**dun**
5.	**gan**	**gen**	**gin**	**ging**	**geng**
6.	**ja**	**jan**	**jao**	**jian**	**jung**
7.	**jin**	**jiu**	**jing**	**juan**	**jun**
8.	**ka**	**ken**	**kin**	**king**	**kong**
9.	**pan**	**pao**	**pea**	**pen**	**pun**
10.	**qa**	**qan**	**qia**	**qin**	**qong**
11.	**ran**	**rei**	**ren**	**run**	**rong**
12.	**sa**	**se**	**si**	**sin**	**sun**
13.	**sha**	**she**	**shi**	**shu**	**shui**
14.	**tai**	**tao**	**ten**	**tin**	**tun**
15.	**tan**	**tang**	**tie**	**ting**	**tiu**
16.	**xi**	**xia**	**xian**	**xiang**	**xing**
17.	**xao**	**xan**	**xang**	**xu**	**xue**
18.	**yan**	**yen**	**ying**	**you**	**yu**
19.	**za**	**zen**	**zi**	**zong**	**zun**
20.	**zha**	**zhi**	**zhin**	**zhu**	**zhuo**

Time of Completion: _____:_____:_____

PART ONE: VOCABULARY TEST (*ZHUYIN*)

SECTION ONE: Do you know any words for them?

Directions: This section tests your knowledge of Chinese vocabulary. You will find 20 groups of Mandarin characters transcribed in *pinyin* or *zhuyin*. Each group consists of five items. Your task is to find out **all** (Note: some may have none or more than one) the items that are **not** Chinese vocabulary and **circle** them on the test sheet. Two examples, a. and b. are provided for your reference. Make sure you know how to do this exercise before you begin. The time you spend will be measured, so please record the time your start and the time you complete this section. Thank you.

Examples:

a. ㄅㄚ　ㄅㄢ　ㄅㄧ　ㄅㄨ　(ㄅㄨㄅ)

b. ㄇㄚ　ㄇㄢ　ㄇㄅ　(ㄇㄧㄚ)　(ㄇㄨㄅ)

Starting Time: _____:_____:_____

1. ㄢ　ㄤ　ㄠ　ㄅ　ㄥ

2. ㄆㄢ　ㄆㄠ　ㄆ　ㄆㄧㄅ　ㄆㄨㄥ

3. ㄔㄢ　ㄔㄠ　ㄔ　ㄔㄨㄅ　ㄔㄨㄥ

4. ㄉㄚ　ㄉㄢ　ㄉㄧ　ㄉㄜ　ㄉㄨㄅ

5. ㄍㄢ　ㄍㄅ　ㄍㄧㄅ　ㄍㄧㄥ　ㄍㄥ

6. ㄐㄚ　ㄐㄢ　ㄐㄠ　ㄐㄧㄢ　ㄐㄩㄥ

7. ㄐㄧㄅ　ㄐㄧㄡ　ㄐㄧㄥ　ㄐㄩㄢ　ㄐㄩㄅ

8. ㄋㄚ　ㄋㄅ　ㄋㄧㄅ　ㄋㄧㄥ　ㄋㄨㄥ

9. ㄆㄢ　ㄆㄠ　ㄆㄝㄚ　ㄆㄅ　ㄆㄨㄅ

10. ㄑㄚ　ㄑㄢ　ㄑㄧㄚ　ㄑㄧㄅ　ㄑㄨㄥ

11. ㄖㄢ　ㄖㄝ　ㄖㄅ　ㄖㄨㄅ　ㄖㄨㄥ

12. ㄙㄚ　ㄙㄜ　ㄙ　ㄙㄅ　ㄙㄨㄅ

13. ㄕㄚ　ㄕㄜ　ㄕ　ㄕㄨ　ㄕㄨㄟ

14. ㄊㄢ　ㄊㄠ　ㄊㄅ　ㄊㄧㄅ　ㄊㄨㄅ

15. ㄊㄢ　ㄊㄤ　ㄊㄧㄝ　ㄊㄧㄥ　ㄊㄧㄨ

16. ㄒㄧ　ㄒㄧㄚ　ㄒㄧㄢ　ㄒㄧㄤ　ㄒㄧㄥ

17. ㄒㄠ　ㄒㄢ　ㄒㄤ　ㄒㄩ　ㄒㄩㄝ

18. ㄧㄢ　ㄧㄅ　ㄥ　ㄧㄡ　ㄩ

19. ㄕㄚ　ㄕㄅ　ㄕ　ㄕㄨㄥ　ㄕㄨㄅ

20. ㄓㄚ　ㄓ　ㄓㄧㄅ　ㄓㄨ　ㄓㄨㄛ

Time of Completion: _____:_____:_____

SECTION TWO: How do they sound?

Directions: Each of the following 16 pairs of word compounds consists of one graphically identical character, which may have identical sounds in the contexts. Please **circle S** for *same*, and **D** for *different*. For example, the answer for Item 1 is **D**. Make sure you know how to do this exercise before you begin. Please record the time your start and the time you complete this section. Thank you.

Starting Time: _____:_____:_____

			Same	Different
1.	嚇阻	嚇唬	S	(D)
2.	行程	行家	S	D
3.	乾坤	乾淨	S	D
4.	好意	好義	S	D
5.	創見	創業	S	D
6.	中風	中鋒	S	D
7.	花卉	花費	S	D
8.	重視	重試	S	D
9.	口吃	吃飯	S	D
10.	音樂	享樂	S	D
11.	於是	於乎	S	D
12.	宗教	教師	S	D
13.	品味	品種	S	D
14.	說書	說客	S	D
15.	長人	家長	S	D
16.	大方	大人	S	D

Time of Completion: _____:_____:_____

SECTION THREE: How well can you tell?

Directions: In the following 16 phrases, please **circle** the best choice (L or R) for given contexts. For example, the answer for Item 1 is the **Right** word in the pair. Make sure you know how to do this exercise before you begin. Please record the time your start and the time you finish this section. Thanks.

Starting Time: _____:_____:_____

		Left	Right
1.	男女老__	幻	(幼)
2.	虎父__子	犬	太
3.	大__世界	干	千
4.	__高八斗	才	寸
5.	精鋭武__	士	土
6.	解甲歸__	田	由
7.	琴棋詩__	晝	畫
8.	不能自__	己	已
9.	四__分明	秀	季
10.	女中__夫	大	丈
11.	自__身價	貶	眨
12.	左__逢源	石	右
13.	九__一毛	午	牛
14.	__人相輕	文	交
15.	__字八法	水	永
16.	__結一生	了	子

Time of Completion: _____:_____:_____

PART TWO: SURVEY

(SAME AS PART TWO OF APPENDIX B)

ANSWERS

Section One: Non-Chinese Words (Pinyin version)

	A	B	C	D	E
1					eng
2				cin	
3					
4				do	
5			gin	ging	
6	ja	jan	jao		
7					
8			kin	king	
9			pea		
10	qa	qan			qong
11		rei		sin	
12					
13					
14			ten	tin	
15					tiu
16					
17	xao	xan	xang		
18		yen			
19					
20			zhin		

Section Two: Same or Different

1.		D
2.		D
3.		D
4.		D
5.	S	
6.		D
7.	S	
8.		D
9.		D
10.		D
11.		D
12.	S	
13.	S	
14.		D
15.		D
16.	S	

Section Three: Left or Right

1.		R
2.	L	
3.		R
4.	L	
5.	L	
6.	L	
7.		R
8.		R
9.		R
10.		R
11.	L	
12.		R
13.		R
14.	L	
15.		R
16.	L	

ANSWERS

Section One: Non-Chinese Words (Zhuyin version)

	A	B	C	D	E
1					ㄥ
2				ㄎㄧㄣ	
3					
4				ㄉㄛ	
5			ㄍㄧㄣ	ㄍㄧㄥ	
6	ㄐㄚ	ㄐㄢ	ㄐㄠ		
7					
8			ㄎㄧㄣ	ㄎㄧㄥ	
9					
10	ㄑㄚ	ㄑㄢ			ㄑㄨㄥ
11		ㄖㄝ			
12					
13					
14			ㄊㄣ	ㄊㄧㄣ	
15					ㄊㄧㄨ
16					
17	ㄒㄠ	ㄒㄢ	ㄒㄤ		
18					
19					
20			ㄓㄧㄣ		

Section Two: Same or Different

1.	D
2.	D
3.	D
4.	D
5.	S
6.	D
7.	S
8.	D
9.	D
10.	D
11.	D
12.	S
13.	S
14.	D
15.	D
16.	S

Section Three: Left or Right

1.	R
2.	L
3.	R
4.	L
5.	L
6.	L
7.	R
8.	R
9.	R
10.	R
11.	L
12.	R
13.	R
14.	L
15.	R
16.	L

APPENDIX D

CONSENT FORM FOR TAPE-RECORDING

Dear Participants,

My name is Shou-hua Lin, a doctoral student of the School of Education, University of Massachusetts at Amherst, Massachusetts.

As part of my doctoral study, I would like to do an informal interview with you. My goal is to get some background information about your learning Mandarin Chinese as a second/foreign language. You will be asked several questions and your answers will be tape-recorded. Your information is just for analytic and statistical purposes in an attempt to better understand your strategies in comprehending reading texts represented in *Pin-yin* and in Chinese characters. Your names will not be mentioned in this study. I need your permission for recording your messages. Your courtesy will be greatly appreciated.

Please sign below if you wish to be tape-recorded.

_____

Shou-hua Lin

I have carefully read and completely understood the above statements and hereby give my permission for tape-recording your interview with me under the conditions stated above.

Signed by _____ Date: _____

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